

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



HSG TECHNIQUE & FINDING

*For
6th year MEDICAL students*

By
Ahmad Mokhtar Abodahab – MD

Lecturer of Radiology
Faculty of Medicine - Sohag University



AHMAD MOKHTAR ABODAHAB – MD

Lecturer ,Training & Teaching Co-ordinator , PACS Unit Admin

Radiology Department Faculty of Medicine – Sohag University

Certified Trainer – Supreme Council of Egyptian Universities

Consultant of Radiology - Sohag Police Clinics & Military Hospital

Lecturer at Virtual Medical Academy – KSA

Lecturer at Virtual Medical Academy – KSA

Consultant of Radiology - Sohag Police Clinics & Military Hospital

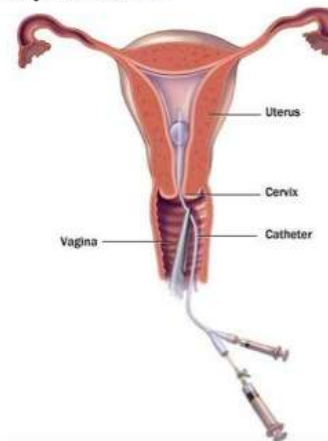
- **Hysterosalpingography (HSG) :**

is the radiographic evaluation of the uterine cavity and fallopian tubes

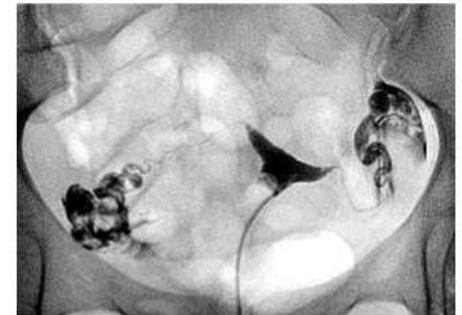
after the administration of a radio-opaque medium through the cervical canal.

Hysterosalpingogram (HSG)

HSG procedure



Normal HSG





Advancing Reproductive Care
With Research. Every Day.

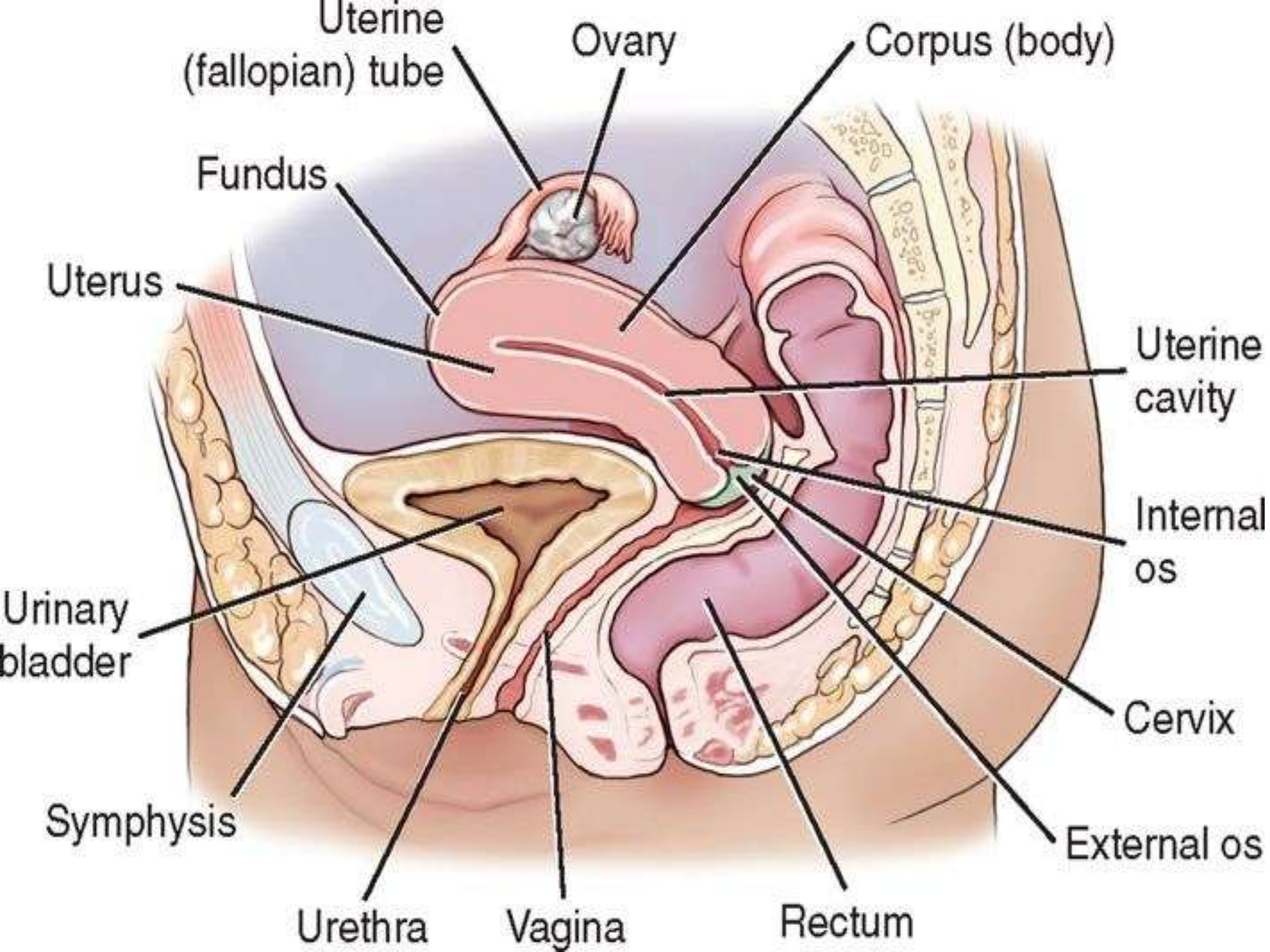
MakeAGIF.com

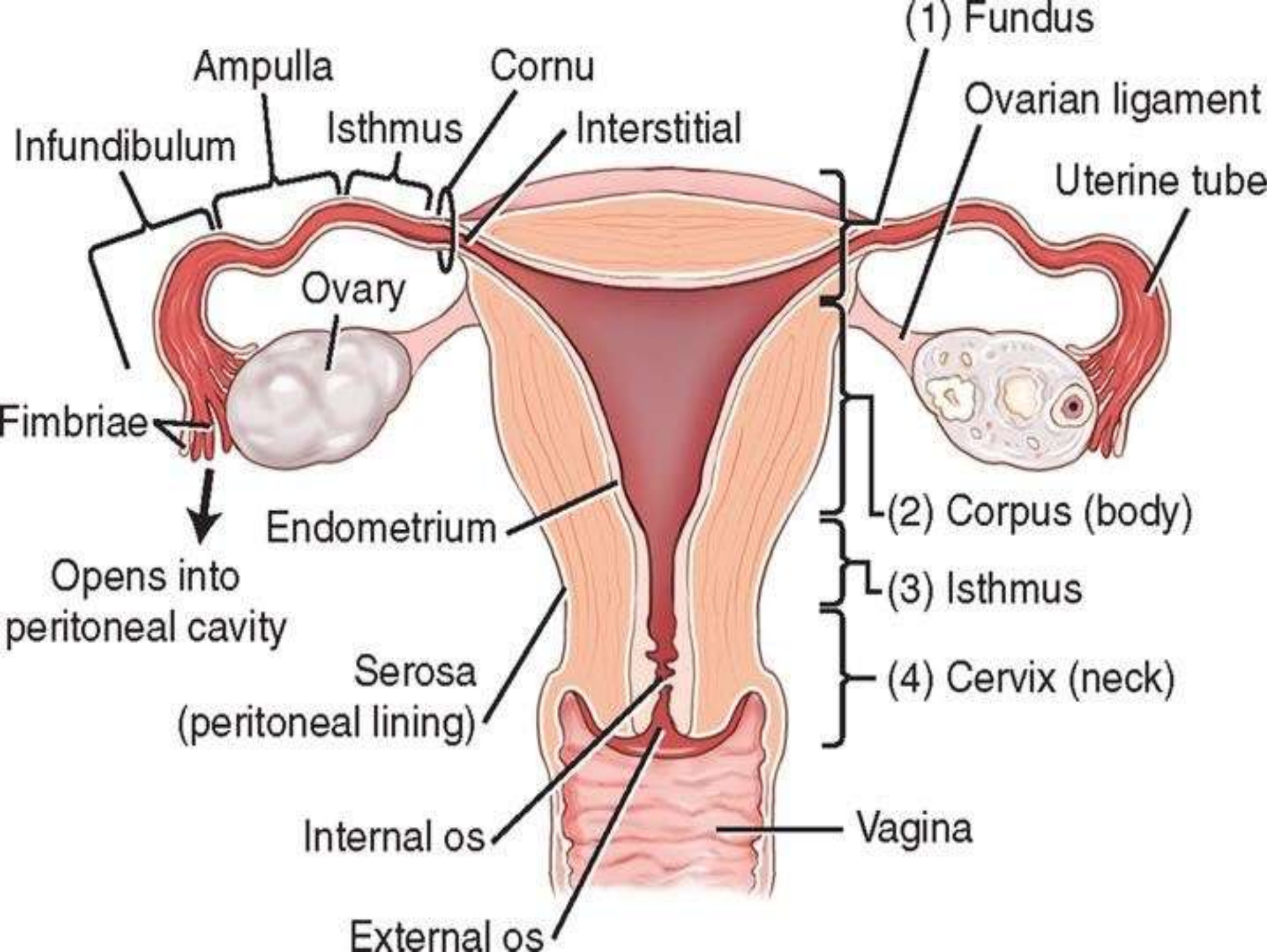
- **Hysterosalpingography (HSG)**

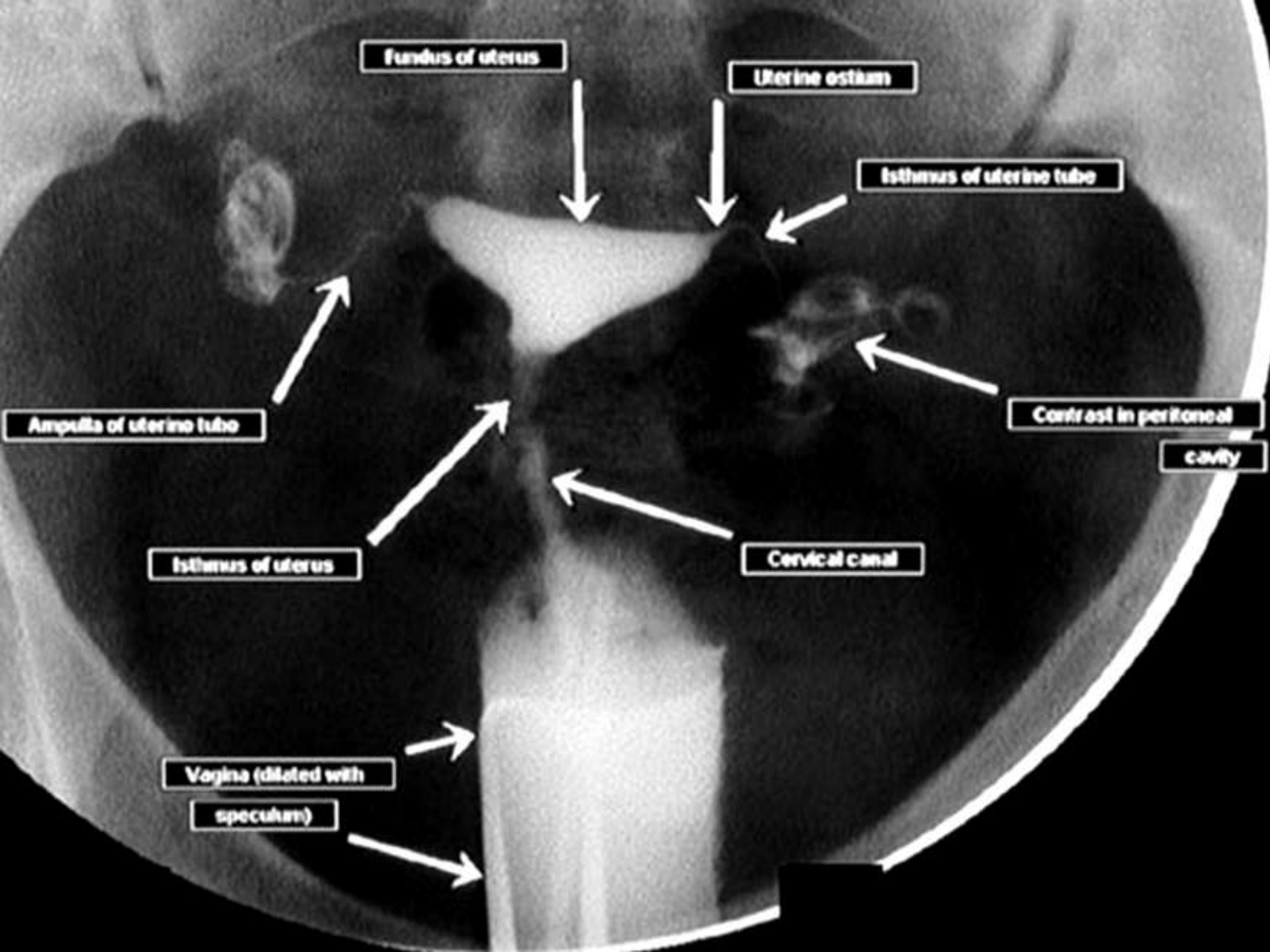
remains an important radiologic procedure in the investigation of infertility .

- **HSG demonstrates :**
 - **morphology** of the uterine cavity,
 - **Patency** of the fallopian tubes.

ANATOMY







History

- The first HSG → 1910
- was considered to be the first special radiologic procedure.



Indications

1- Infertility assessment:

- most common indications
- Diagnose functional or structural defects.

• **In some cases**, HSG can be a *therapeutic tool*.

- Injection of contrast media → dilate a narrowed, tortuous, or occluded
uterine tube

- 2- Evaluate ***frequent miscarriages***
- 3- Evaluate uterine abnormalities
 - Congenital uterine anomalies
 - Fibroids or tumor masses
 - Adhesions
- 4- Evaluate tubal patency
 - Following tubal ligation reversal procedure
 - Following pelvic **inflammatory** disease

- 5-Evaluation of **Abnormal menses**
- 6- **preoperative control** → uterine or tubal surgery.

Risks Vs Benefits

- *Minimally invasive* procedure
- Rare complications
- *Valuable information*
- *Minimal exposure* to radiation
 - *Effective radiation dose ~ 1 mSv (comparable to average amount of background radiation over 4 mo)*
- **Must not** be performed if patient is query *pregnant* at the time of the procedure

- Despite the of *newer imaging* modalities, HSG still *remains the best* procedure to image the fallopian tubes.

Sensitivity

- 58% → for polypoid lesions,
- 0% → for *endometrial hyperplasia*.
- 44.4% → for uterine malformations,
- 75% → for the detection of intrauterine adhesions.

Contraindications:

1- *Possible Pregnancy :*

- **main contraindication .**
- *Avoided by* : performing HSG before the ovulation phase, “between the 7th to 10th day of the menstrual cycle”

2- *Active* intrapelvic *inflammation*.

3- *Bleeding* vaginal or uterine

4- Recent uterine or tubal *surgery*

General contraindications :

- severe cardiac or
- renal deficiency,

Patient Preparation

- **Timing:**

the first half of the menstrual cycle following cessation of bleeding. Due to

- Endometrium is thin during this proliferative phase, → facilitates better image interpretation
- Ensure that there is no pregnancy.

- **Second half of the cycle is avoided because :**
 - the **thickened secretory-phase** endometrium → increases the risk of **venous intravasation** and may cause a false-positive diagnosis of cornual occlusion.
 - Possibility of pregnancy.

Bowel preparation :

To reproductive tract obscuring by bowel gas and/or feces.

→ Preparation may include a mild laxative, suppositories, and/or a cleansing enema be

Bladder Voiding :

emptying bladder immediately before the examination →
prevent displacement of the uterus and uterine tubes,.

- ***Antibiotics :***
- ***Pain Killer:***
- ***Steroid (prednisolone)***
- ***Antispasmodics :***

TECHNIQUE



Procedure

.....In a simple words

- A **speculum** is inserted into the vagina
- A **catheter** is then inserted into the cervix
- **Contrast** material is injected into the uterine cavity through the catheter
- **Fluoroscopic images** are then taken

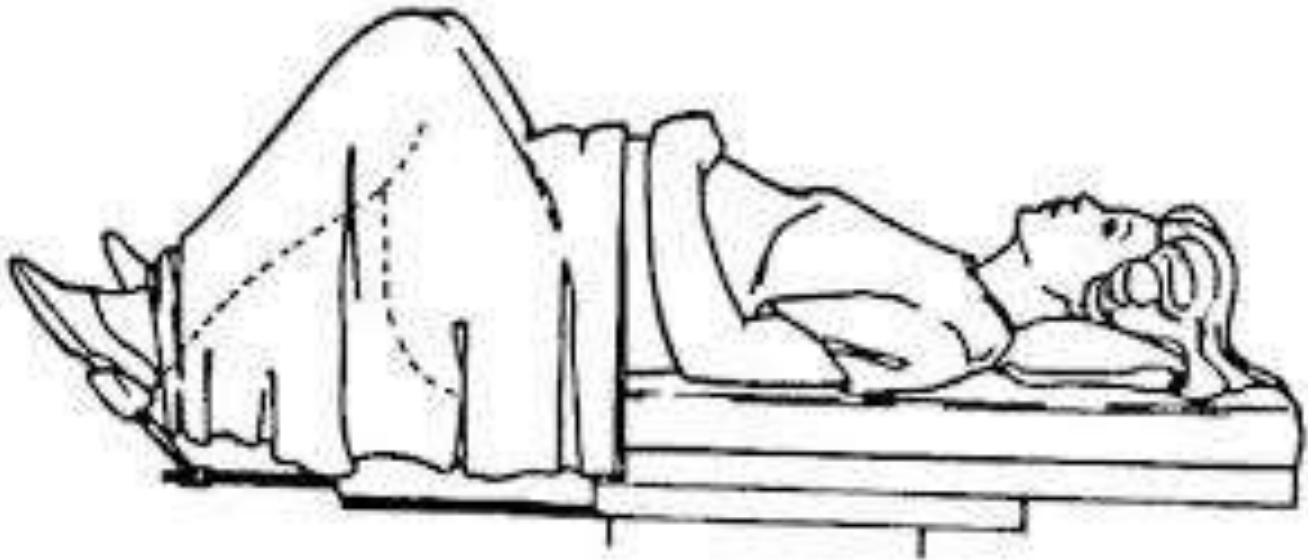
Technique

- The patient is placed on the *fluoroscopic machine* .



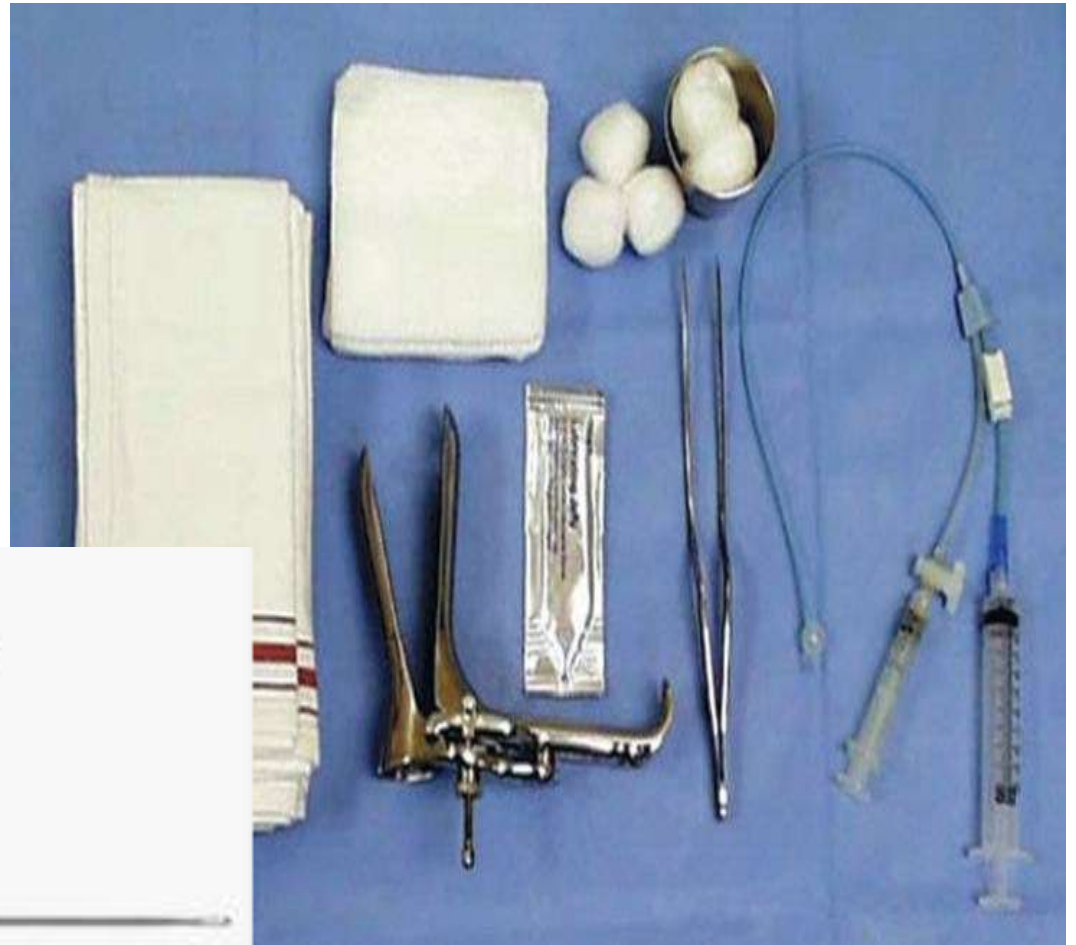
- **Position:** Gynecologic examination

the patient bends her knees and places her feet at the end of the table.



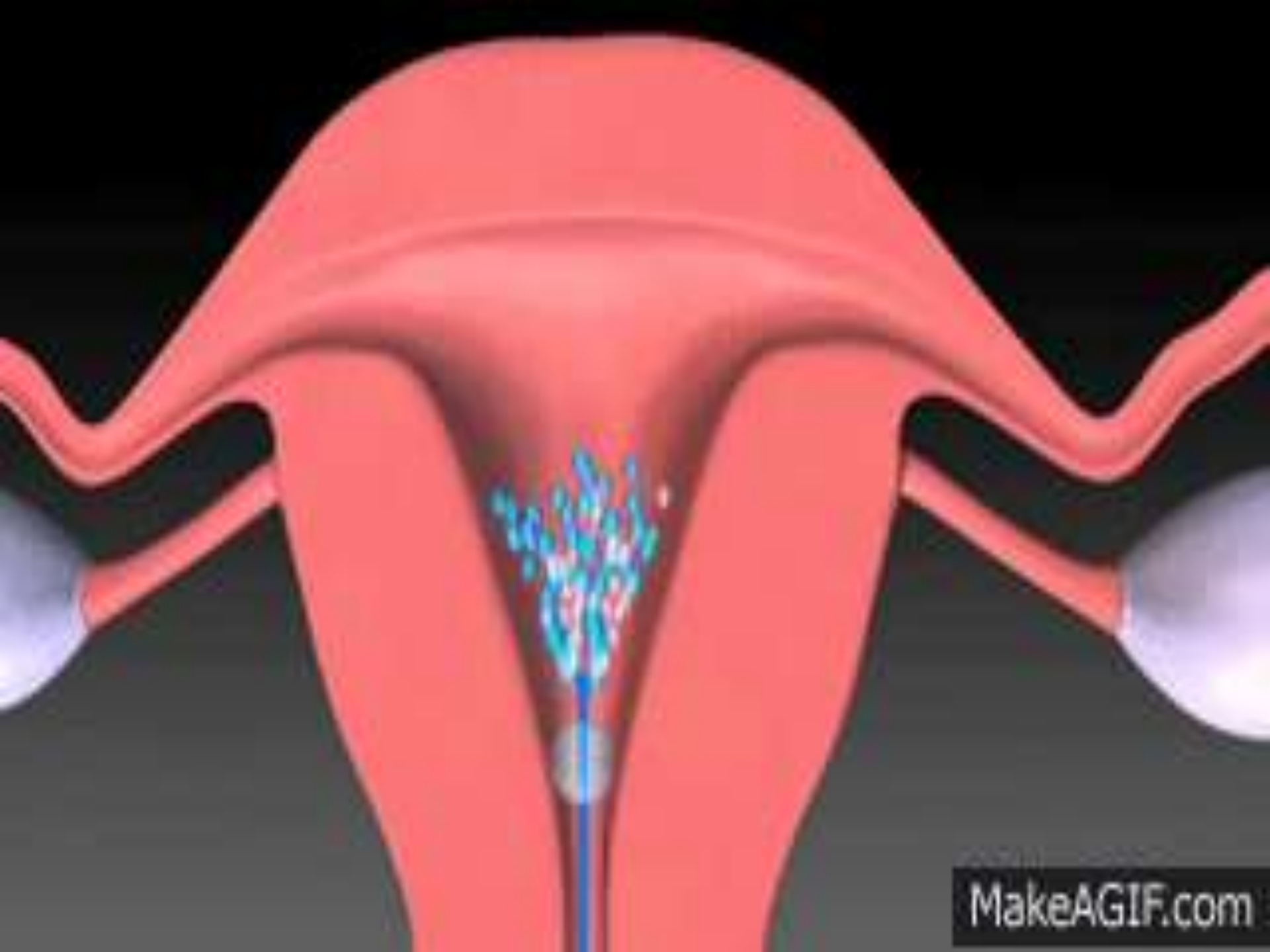
- Cleaning the external genital area with antiseptic solution,
- Casco speculum: The vagina is dilated by a gynecologic dilator.
- The cervix is localized and cleansed with iodine solution.

Equipments



Some Forms of Catheters





Contrast Media

→ *Two categories* of iodinated contrast media

→ I - Water-soluble *iodinated* contrast media,

such as Omnipaque 300, is preferred.

- It is absorbed easily,
- Does not leave a residue, and provides adequate visualization.

II- oil-based contrast media

Allow maximal visualization of uterine structures.

- However, it has a very slow absorption rate
- persists in the body cavities for an extended time.

Risk of oil embolus that could reach the lungs.

→ Amount of contrast :

- variable, “About **5 : 15 ml**”
- average, **approximately 5 ml** is necessary to fill the uterine cavity,
- An additional **5 ml** is needed to demonstrate uterine tube patency.





Complications

- The **two most common** complications of HSG are **pain** and **infection**.
- SimplyComplications are related to
→ **technique** → **Contrast** & → **Radiation**
- Complications may be : **General** or **Local**

1-Uterine contractions and discomfort:

- due to the introduction of contrast medium into the uterine cavity → Dilating it.
 - more diffuse pain, caused by irritation of the peritoneum due to the contrast.
- ***Pain can be minimized*** by :
 - slowly injecting the contrast medium
 - using isosmolar contrast agents.

2- Post-procedural infection:

Spreading and generalization of inflammation may happen in cases of chronic inflammation.

3- Vasovagal reaction:

A possible reaction to manipulation of the cervix or inflation of balloon in the cervical canal.

4- Traumatic elevation of endometrium by the inserted cannula:

A complication which does not cause significant consequences.

5- Uterine perforation and tubal rupture:

are very rare.

6- Intra-vasation of contrast media:

- **Venous or lymphatic**
 - water-based contrast medium → no adverse effect on the patient,
 - But it can make interpretation of the image difficult. It occurs more commonly in the presence of fibroids or tubal obstruction.
- It could occur if :
 - Rapid injection,
 - If the endometrium is injured during the catheterization, or
 - if the examination is performed during menstruation.

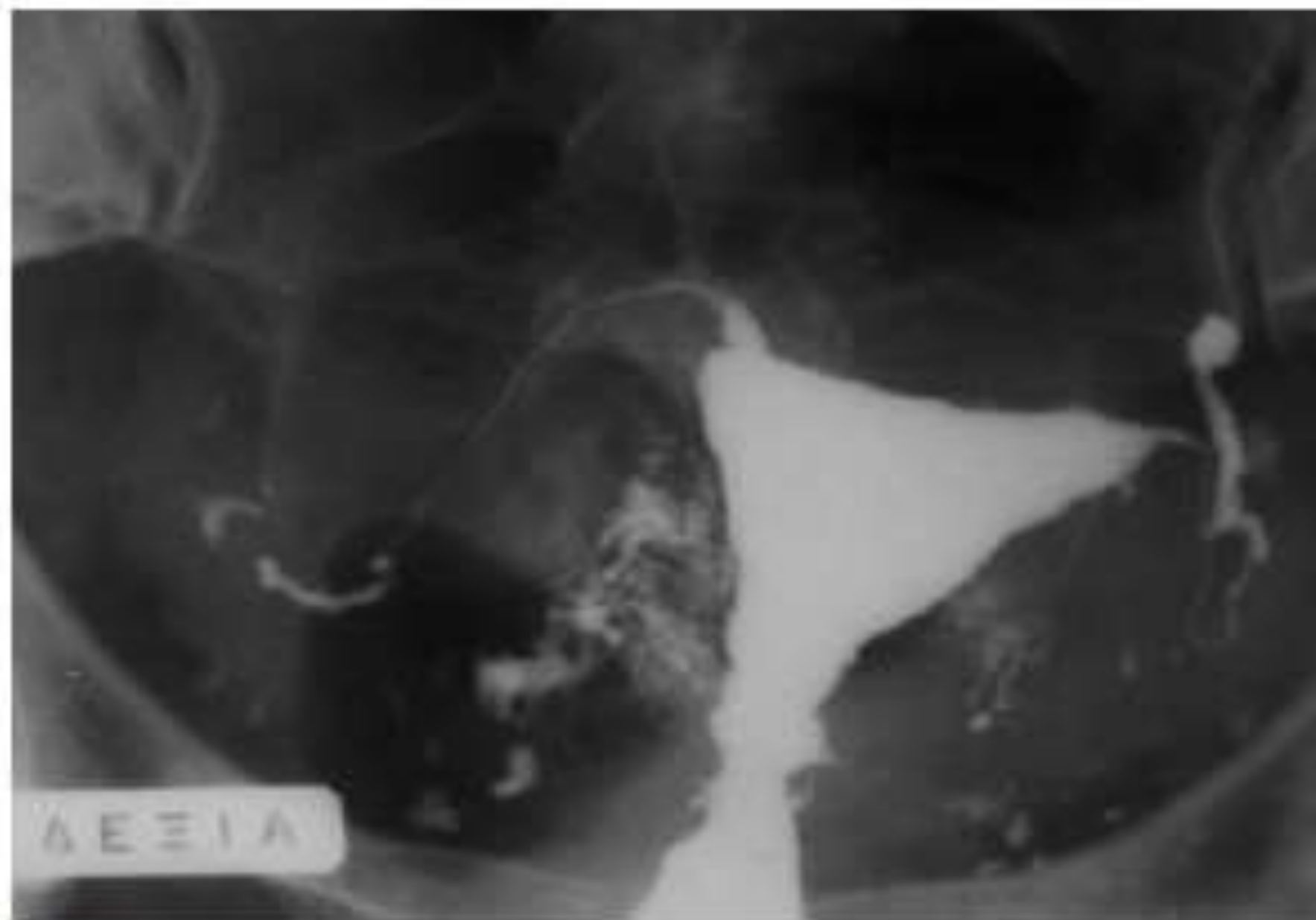


FIG 1. Extravasations of the contrast medium. Presence of contrast medium in the peritoneum.

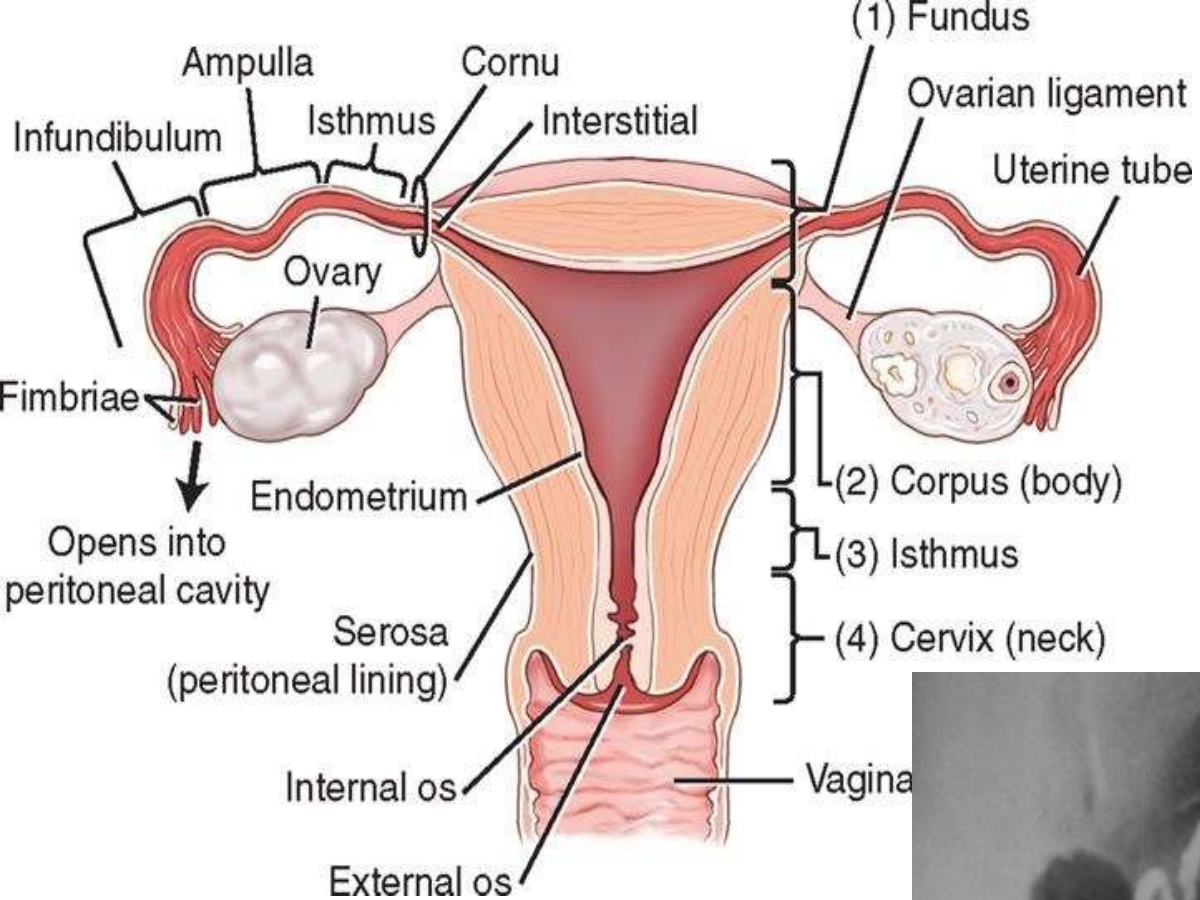
7- Allergic reaction to contrast media:

- very uncommon with low-osmolar nonionic contrast agents currently available.

8- Radiation exposure to the ovaries:

Exposure is minimal and can be reduced if the proper technique is utilized.

Normal Findings



- ***Uterine cavity :***

- Trigonal shape .
- The apex of the triangle is the isthmus, → nearly 3.7 mm wide.
- Is pointed downwards
- connected to the internal ostium of the cervix uteri,
- The base of triangle is the fundus, which can be concave, flattened, or slightly convex.
- On both sides of its base, in the area of the lateral horns,

- ***Cervix:***

- is 2.5 cm in total length.

- ***The fallopian tubes :***

- separated into three segments:

- 1- Isthmus (attached to the uterus, not imaged in several cases),

- 2- Ampullary :

- in the middle,

- the longest and widest segment,

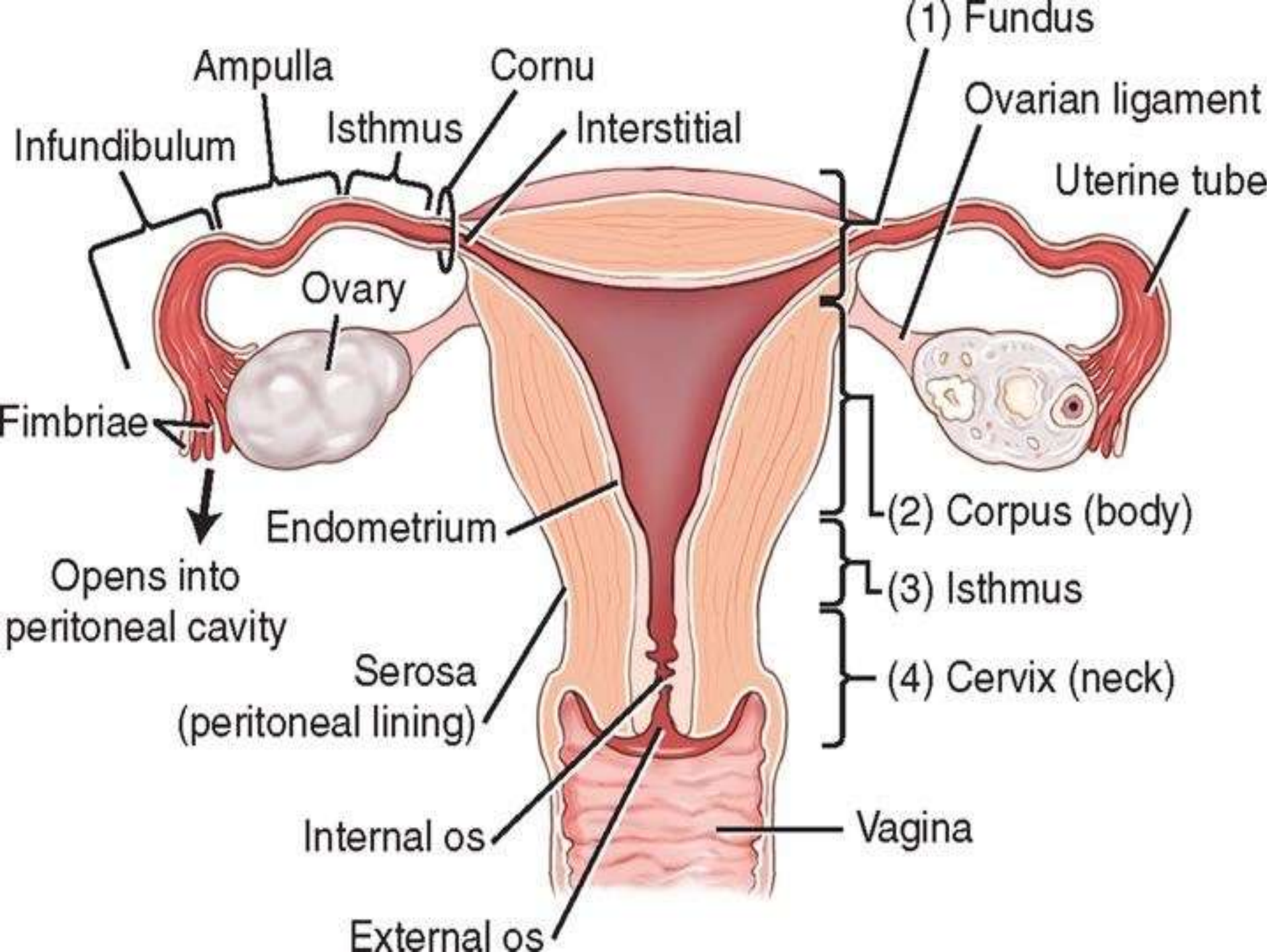
- 3- Infundibulum : bell-shaped (to the distal end).

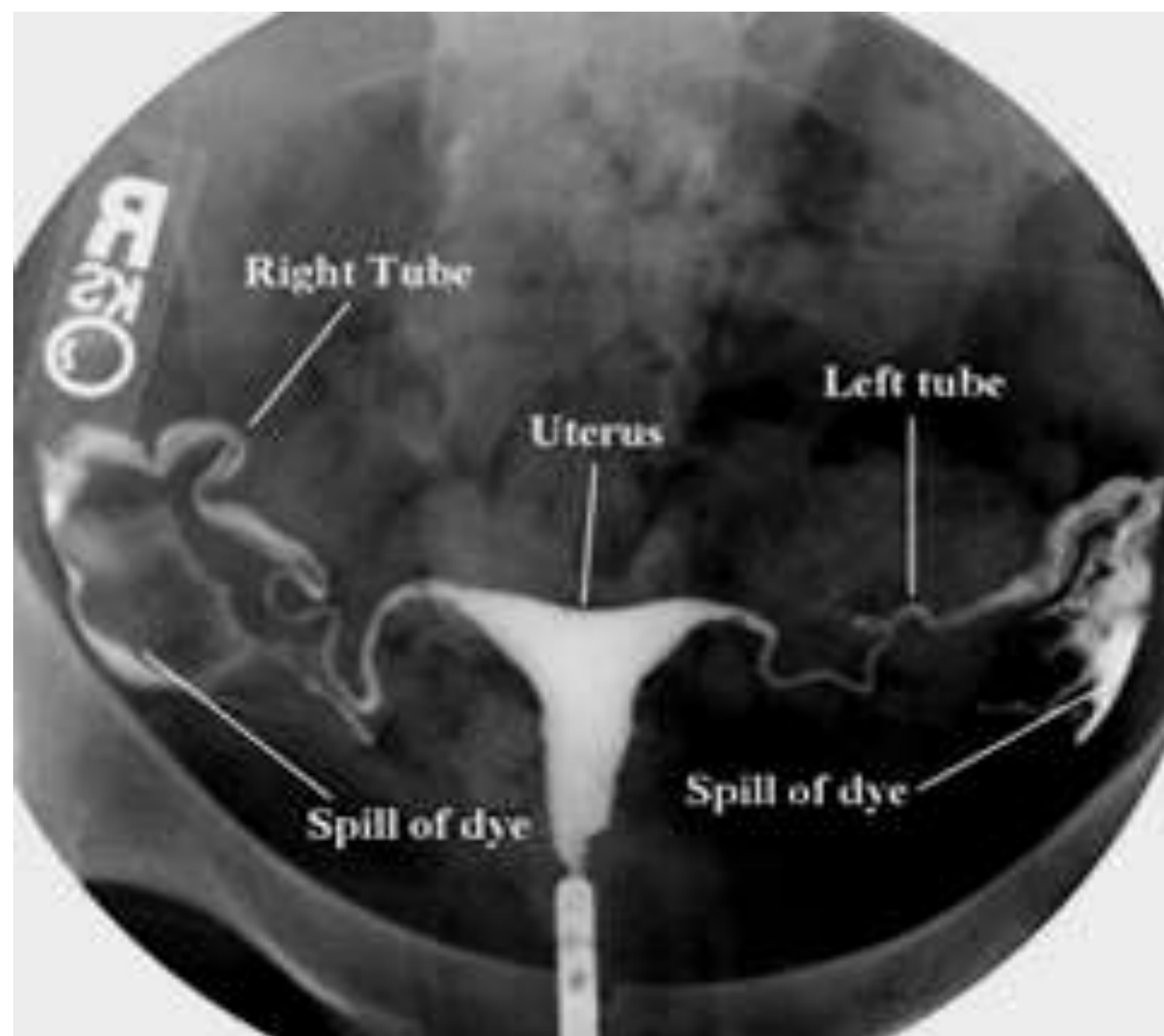
- **There are two ostiums:**

- Internal or uterine, and

- External or abdominal → through it contrast diffuses into the peritoneal cavity

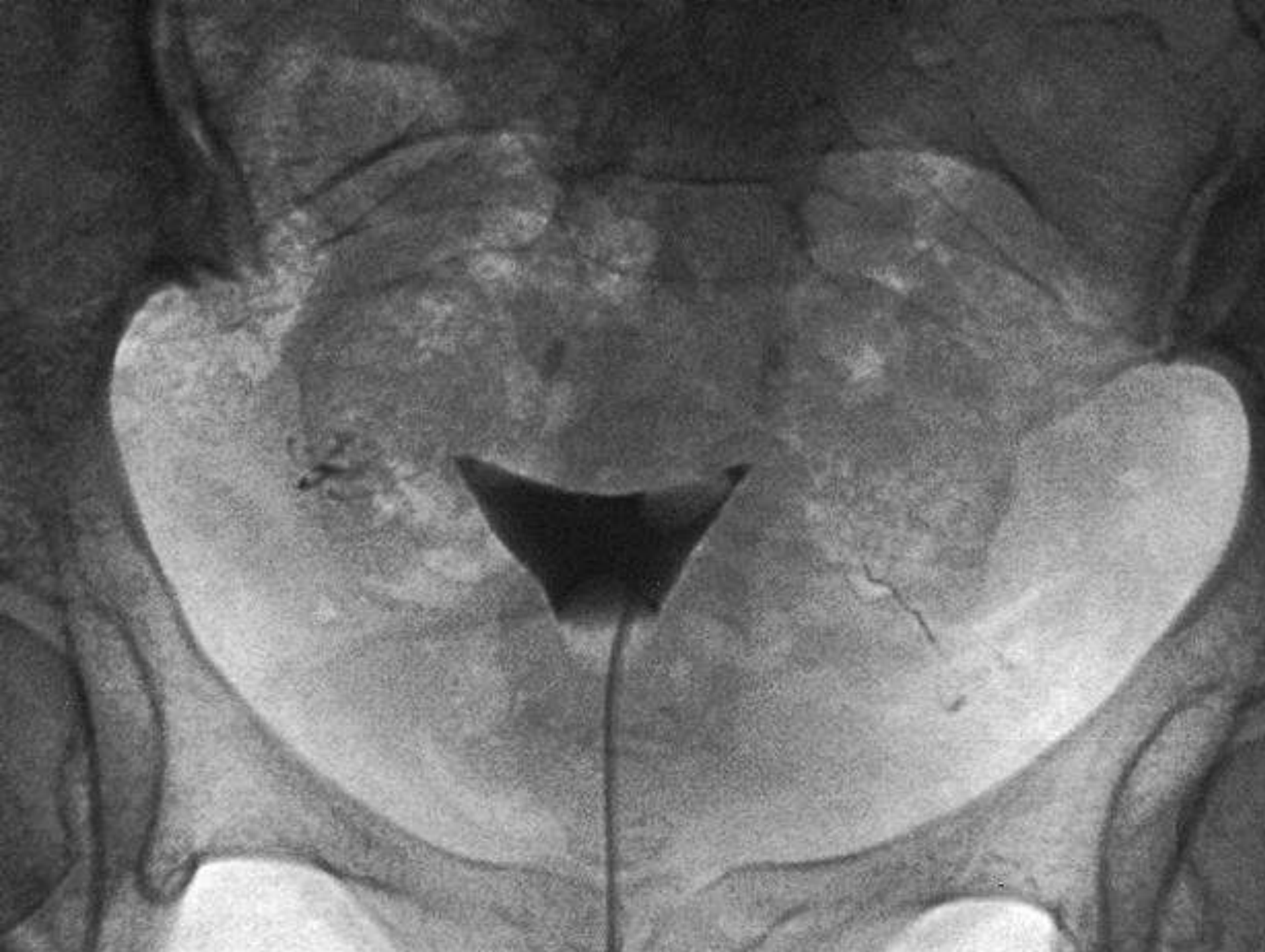
- Remaining contrast medium in the furrows of the peritoneum can be observed up to **3** **hours** after administration.

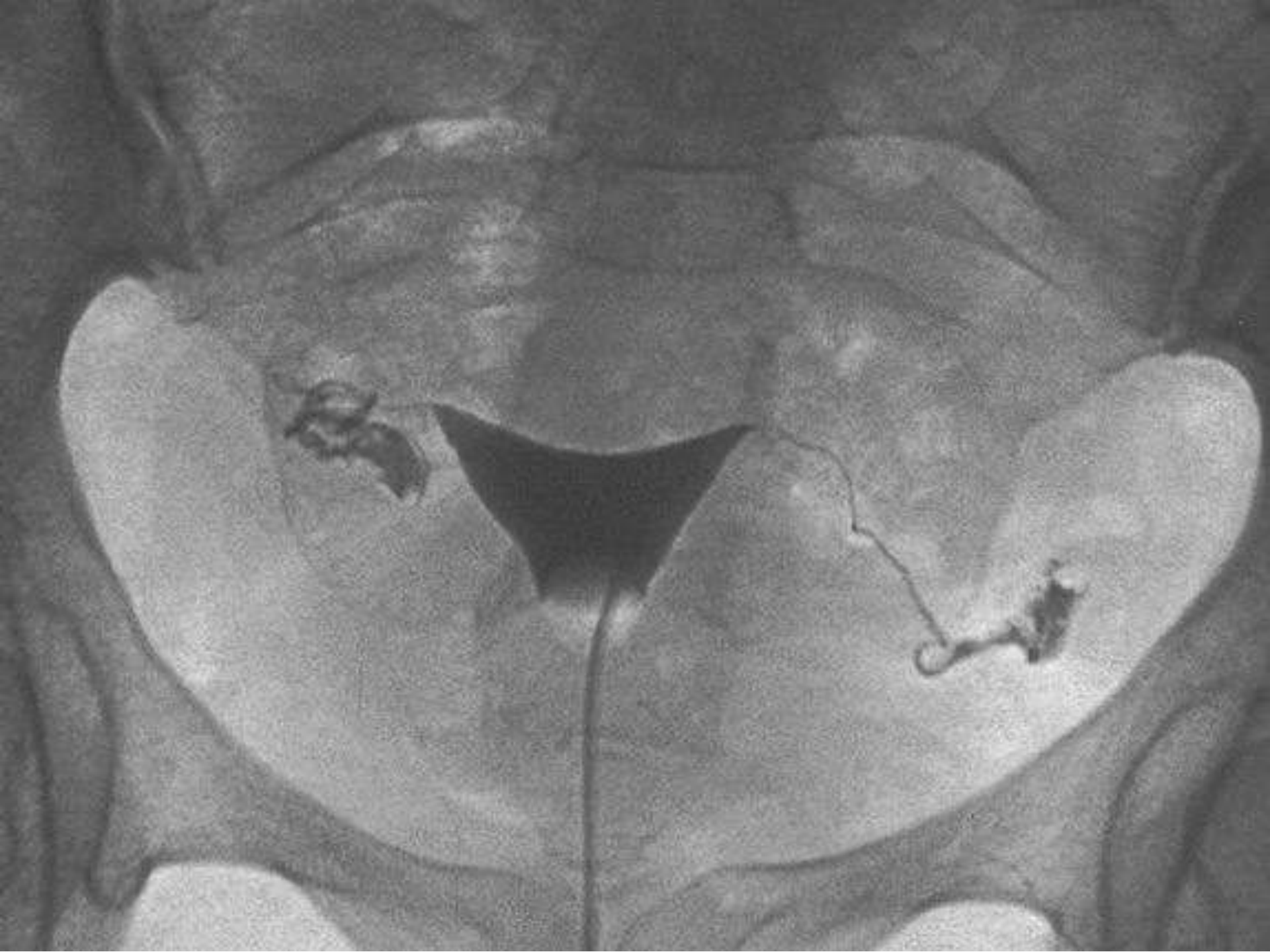




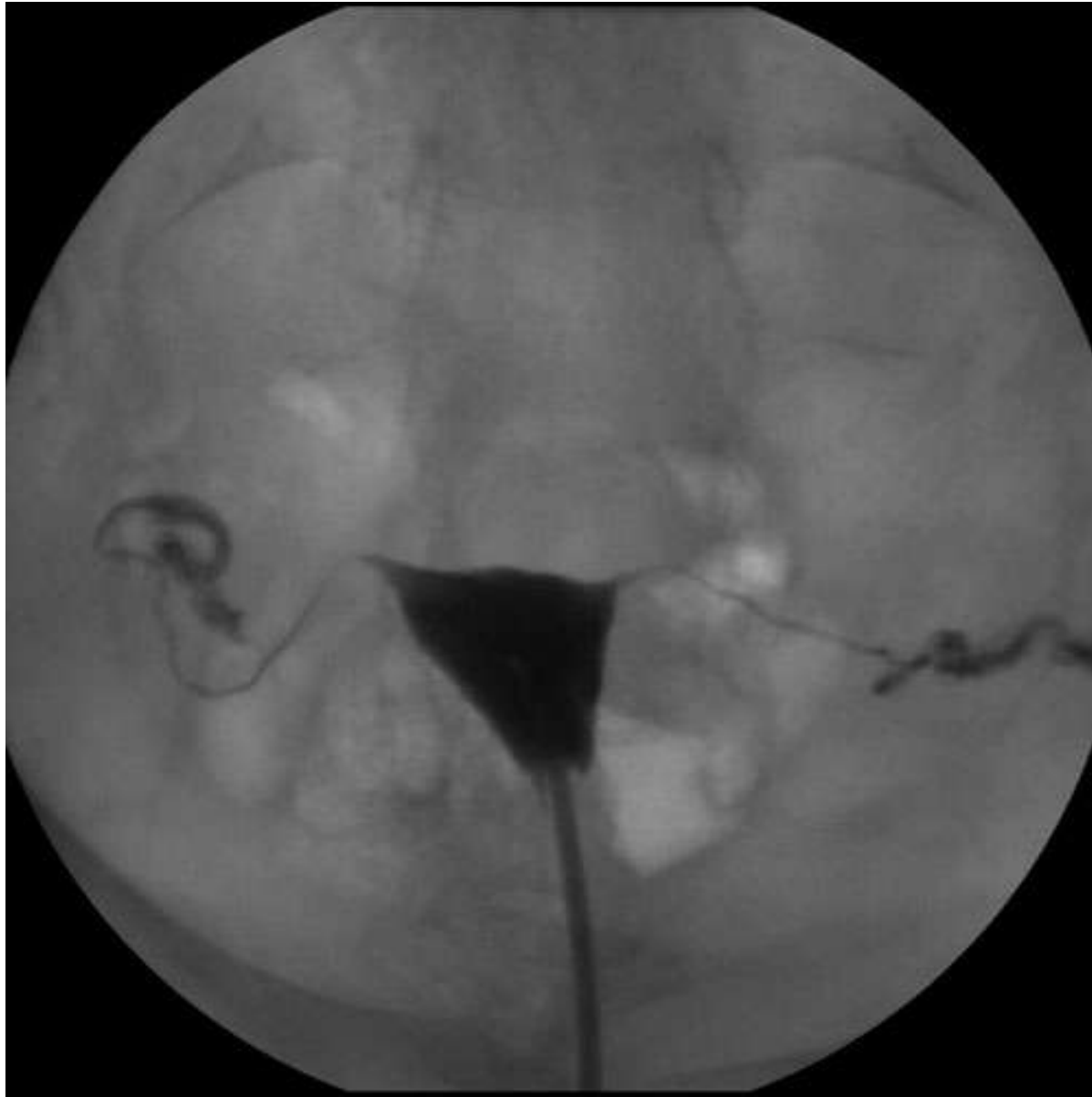
Scout

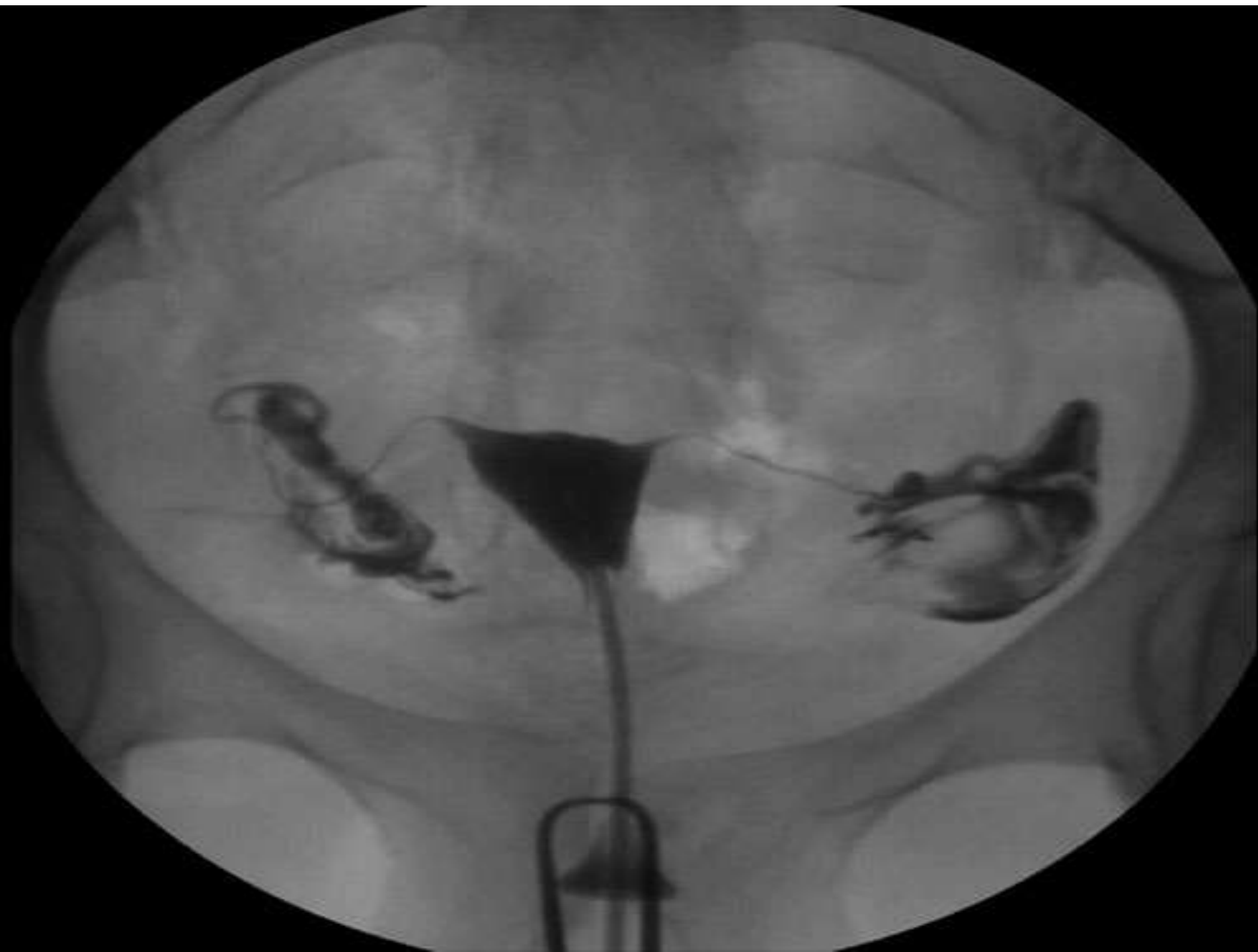






Normal Hysterosalpingograms







NORMAL

Comment on:

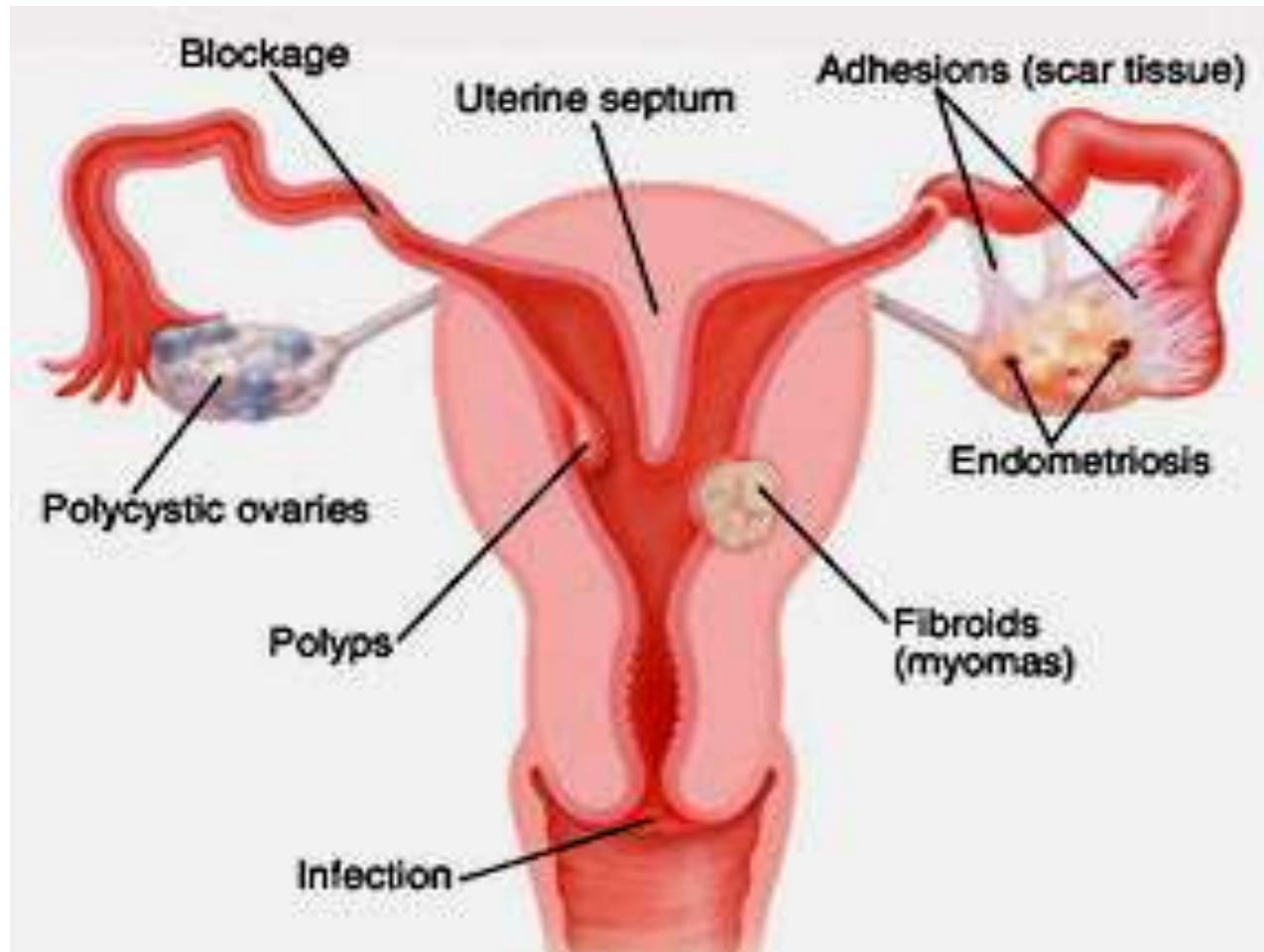
Uterine cavity: size & shape

Fallopian tubes: calibre, mucosa, patency

Free spill

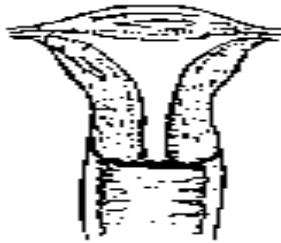
Homogenous smearing

Abnormal Hysterosalpingogram

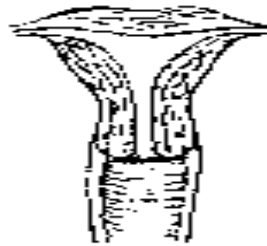


Congenital Uterus Anomalies

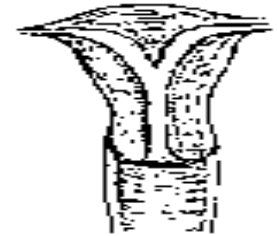
Classification of Uterine Anomalies



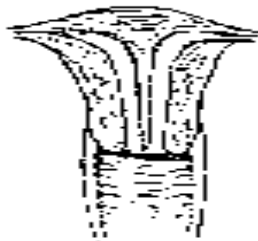
Normal



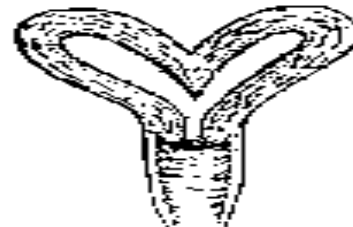
Arcuate



Subseptate



Septate



Bicornuate
(unicollis)



Bicornuate
(bicollis)



Didelphys



Unicornuate



Hypoplastic

- Caused by incomplete junction of the paramesonephric ducts (Muller ducts),
- Majority of women with mullerian duct anomalies have reproductive problems :
 - little chance of conceiving,
 - higher rates of spontaneous abortion,
 - higher rates of premature delivery
 - Abnormal fetal position

- **Primary infertility**

In such cases has an extra uterine cause and is not generally attributable to mullerian duct anomalies alone.

- **Cervical incompetence :**

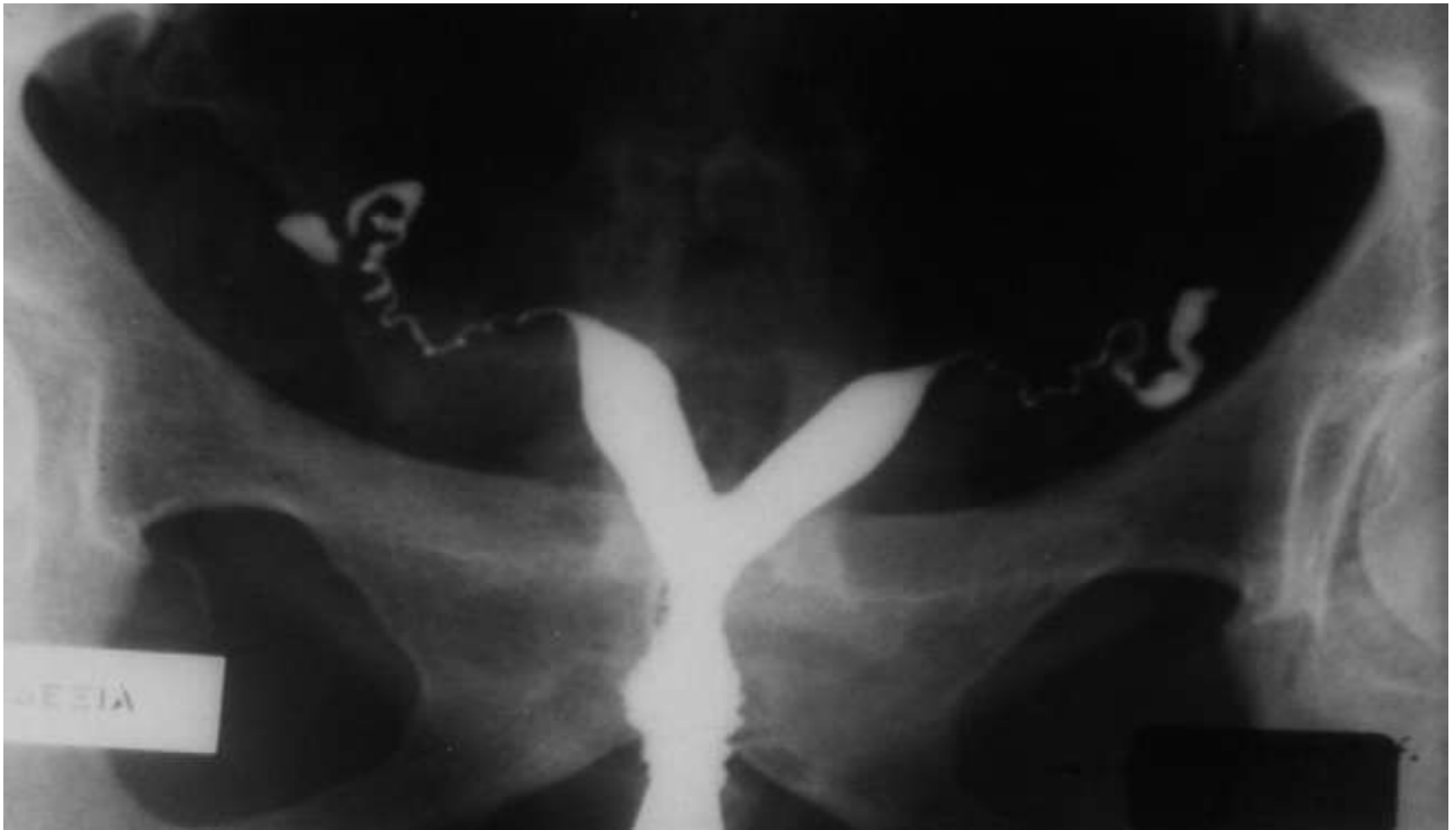
Has been reported to be associated with these anomalies.



- ***Unicornous uterus.***
 - Hysterosalpingography shows opacification of a single right uterine horn.
 - A single fallopian tube is also visualized.



- Didelphys uterus.
 - Hysterosalpingography shows two uterine cavities, two cervices, and one single vagina.

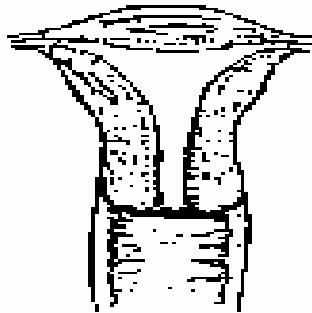


- Bicornate uterus.
 - Spot radiograph shows two uterine horns.
 - The fallopian tubes are also visualized at this imaging stage.

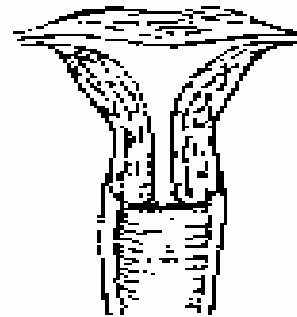


Arcuate uterus. Hysterosalpingography demonstrates a depression of the uterine fundus, compatible with an arcuate uterus. • —

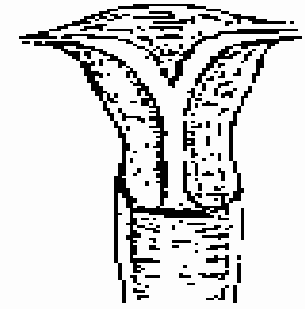
Classification of Uterine Anomalies



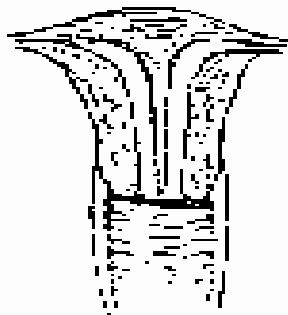
Normal



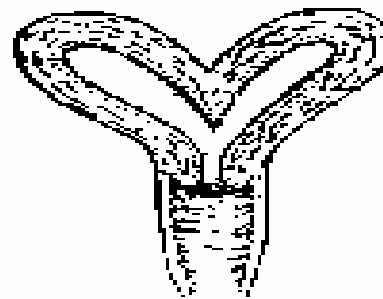
Arcuate



Subseptate



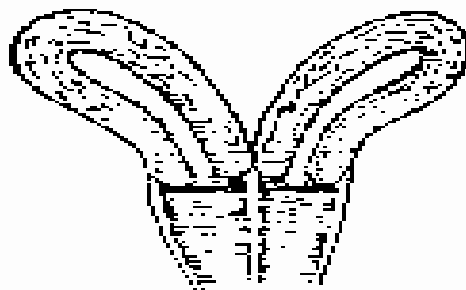
Septate



Bicornuate
(unicollis)



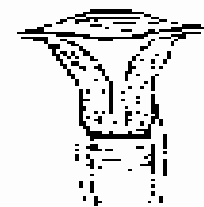
Bicornuate
(bicollis)



Didelphys



Unicornuate



Hypoplastic

N.B. MRI is important for further assessment of many cases especially “Double cavity” categories.



- ➔ ***Small sized Uterus “Hypoplastic” :***
 - caused by *inadequate hormonal stimulation* as a fetus,
 - Small uterine cavity size with normal vaginal length
 - A common finding in cases of female infertility.



- **Small size** of the uterus cavity with normal length of the vagina

Non congenital Abnormal Findings

Fibromyomas

- **Submucosa fibromyomas** → are imaged as smooth filling defects in the uterine cavity.
- DD:
 - endometrial polyps
 - possible pregnancy.
- **Small intramural fibromyomas :**
 - Do not distort the endometrial cavity
 - Not visualized on HSG.
- **Subserous fibromyomas :**
 - only if they are located in the lateral walls of the uterus. → smooth filling defects or smooth Depression of the fallopian tubes



Submucosa fibromyoma. •

Contrast deficiency “filling defect” with smooth border at the fundus of the uterus.

Endometrial Polyps

- focal overgrowths of the endometrium.
- usually manifest as well-defined filling defects and
- Best seen during the early filling stage.
- Small polyps may be obscured by contrast filling.

Internal Endometriosis (Adenomyosis)

- ectopic islets of active endometrium in the muscularis wall of the uterus.
- It is usually imaged as a pointed projection of 2 to 3 mm length, perpendicular to the uterine wall
- Rarely, this is imaged as a sack-shaped projection filled by contrast medium, 4 mm to 1 cm in length.

→ Differential diagnosis :

- **hyperplasia of the endometrium** and the entrance of the contrast medium in the myometrium or
- in the nutrient arteriole of submucosa fibromyomas.



- Endometriosis.
Sack-shaped projection full of contrast medium

Uterine Cancer

- manifests as an ***irregular filling defect***,
- rarely diagnosed by the HSG method.



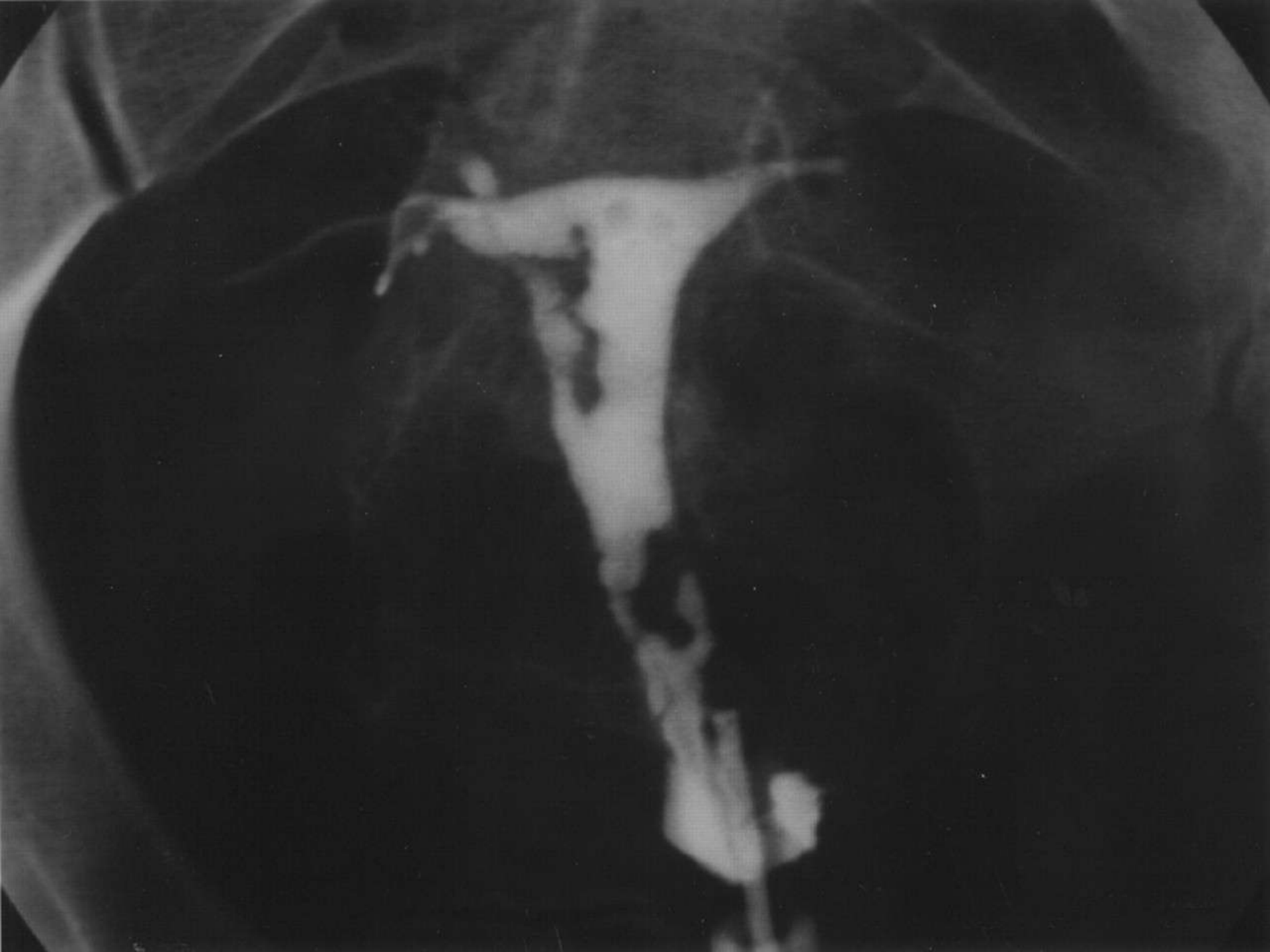
Uterine cancer.
Large contrast
deficiency “Filling
defect” with
abnormal
border at the left
lateral uterus wall,
which is indicated.

Intrauterine Adhesions

- most commonly endometrial trauma of curettage.
- also in chronic endometriosis due to tuberculosis.
- Intrauterine adhesions manifest as irregular

filling defects, → most commonly as linear filling

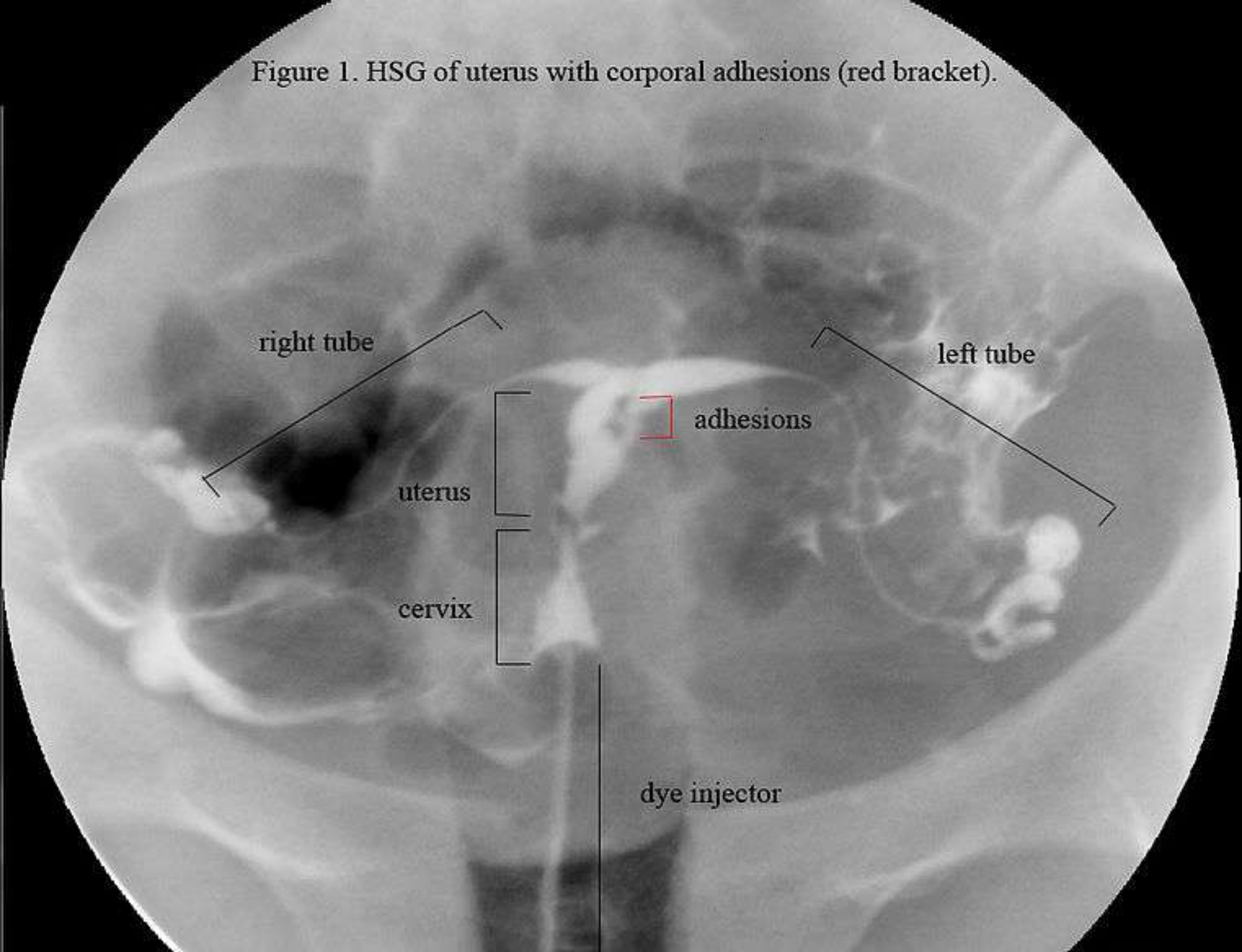
defects arising from one of the uterine walls.



Asherman's syndrome

- is a condition characterized by:
adhesions and/or **fibrosis** of the endometrium most often associated with dilation and curettage of the intrauterine cavity.
- was first described in 1894 by Heinrich Fritsch (Fritsch, 1894)
& further characterized by Israeli gynecologist Joseph Asherman in 1948.

Figure 1. HSG of uterus with corporal adhesions (red bracket).



ALPALAH



06-06-22
23-Apr-2009
75 kV, 220 mA, 30 ms

S1
SBAN KINALPULAH



06-06-22
23-Apr-2009
75 kV, 220 mA, 30 ms

ALPALAH



06-07-20
23-Apr-2009
75 kV, 220 mA, 30 ms

S1
SBAN KINALPULAH



06-07-20
23-Apr-2009
75 kV, 220 mA, 30 ms

ALPALAH



06-07-20
23-Apr-2009
75 kV, 220 mA, 30 ms

S1
SBAN KINALPULAH



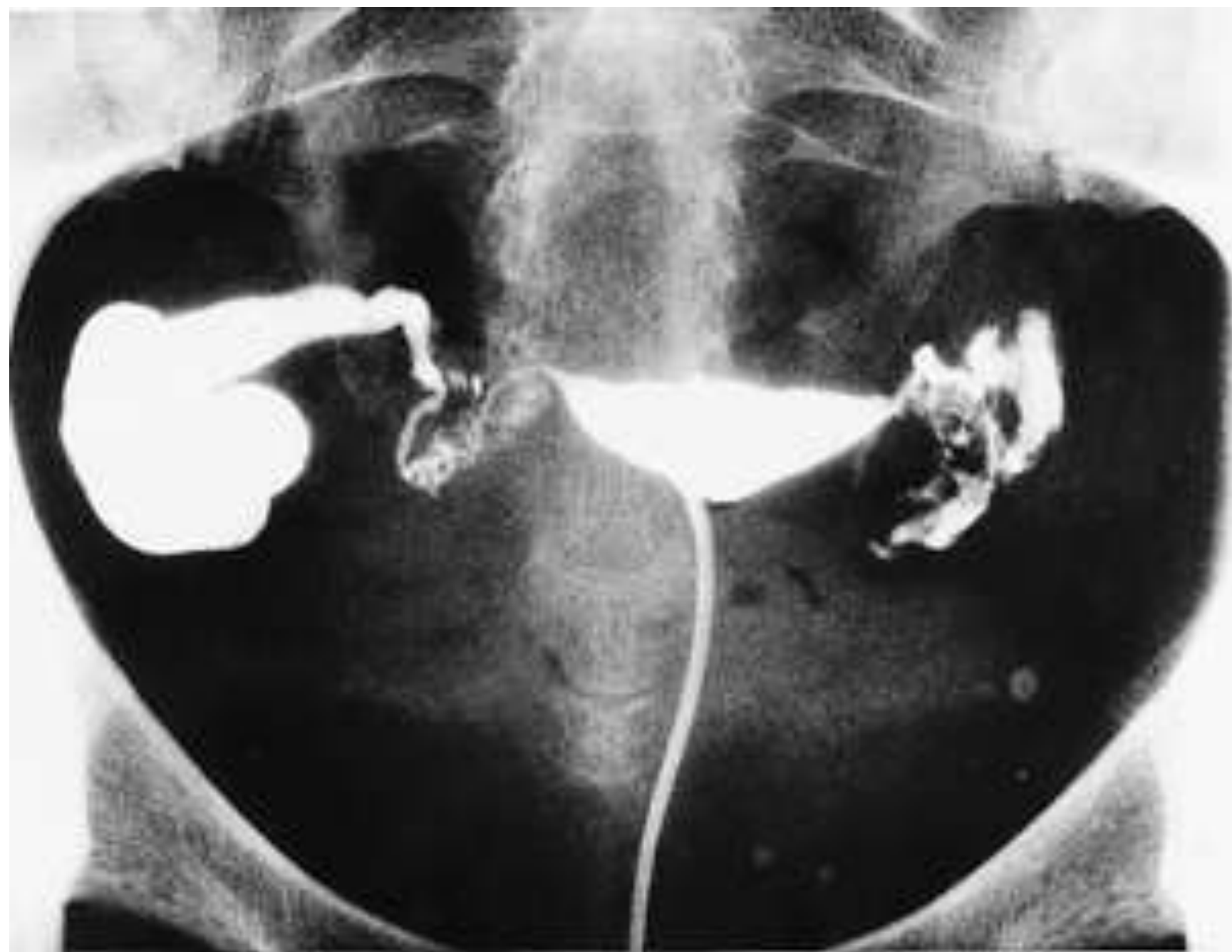
06-07-20
23-Apr-2009
75 kV, 220 mA, 30 ms

Hydrosalpinx

➔ *HSG is the best method for visualizing and evaluating the fallopian tubes.*

- Commonly results from a **previous inflammation** of the fallopian tubes (salpingitis).
- Distal tubal occlusion, ➔ dilation of the proximal segment.
- The radiologic image shows a dilated lumen in one or more spots, ➔ contrast will not pass to the peritoneal cavity

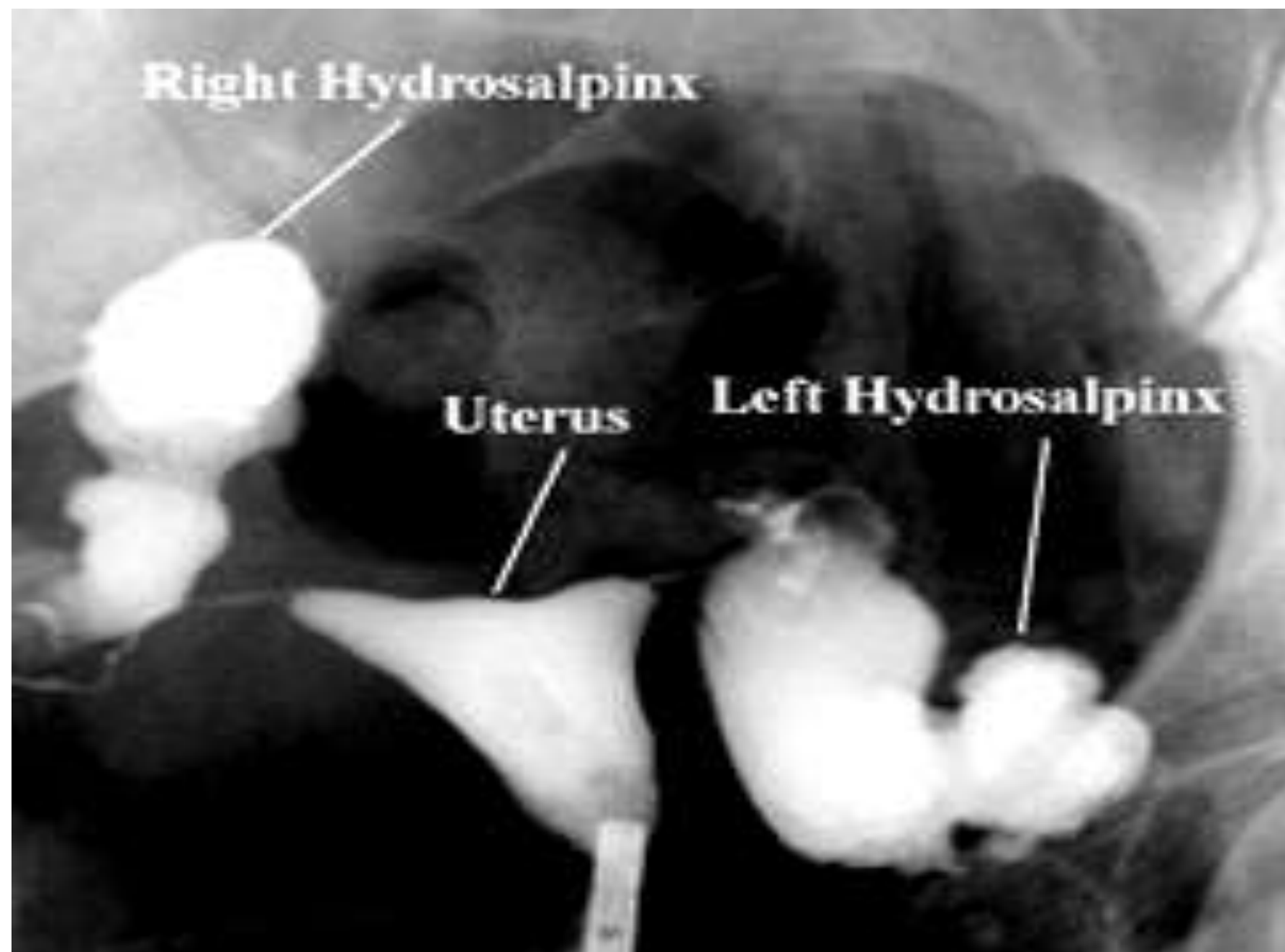




Right Hydrosalpinx

Uterus

Left Hydrosalpinx



Salpingitis Isthmica Nodosa

- a disease of **unknown etiology**,
- **characterized by :**
 - multiple small outpouchings or diverticula
 - Affecting one or both fallopian tubes.
- It is presumably caused by pelvic inflammatory disease or endometriosis .
- Is associated with ectopic pregnancy and infertility.⁹



Nodosa isthmica salpingitis.

Presence of small projected spots full of contrast medium, parallel to the fallopian tube.



Non Filling of the Fallopian Tubes



Non Filling of the Fallopian Tubes

- *This is the most common finding during the examination .*

➔ Usually caused by:

- poor technique,
- spasm, or
- obliteration of the fallopian tube.

➔ *Poor technique includes:*

- imperfect straightening of the external cervical ostium
- Inadequate amount of contrast medium in the uterine cavity.

→ Spasm Vs Obliteration :

- The ***cornual portion*** of the fallopian tube is encased by the smooth muscle of the uterus
- If there is a **spasm** of the muscle during HSG, one or both tubes may not fill.
- **Tubal spasm Vs tubal occlusion** cannot be distinguished .

→ ***This could be avoided by:***

- progressive administration of the contrast medium
- Administration of a **spasmolytic agent** to relieve spasm, → helping differentiate cornual spasm from true occlusion.

- **Obliteration** is usually caused by :
 - inflammation or
 - uterine surgery
- **manifests as :**
 - Non-opacification or
 - Abrupt cutoff of the fallopian tube → with ***no free intraperitoneal spillage.***

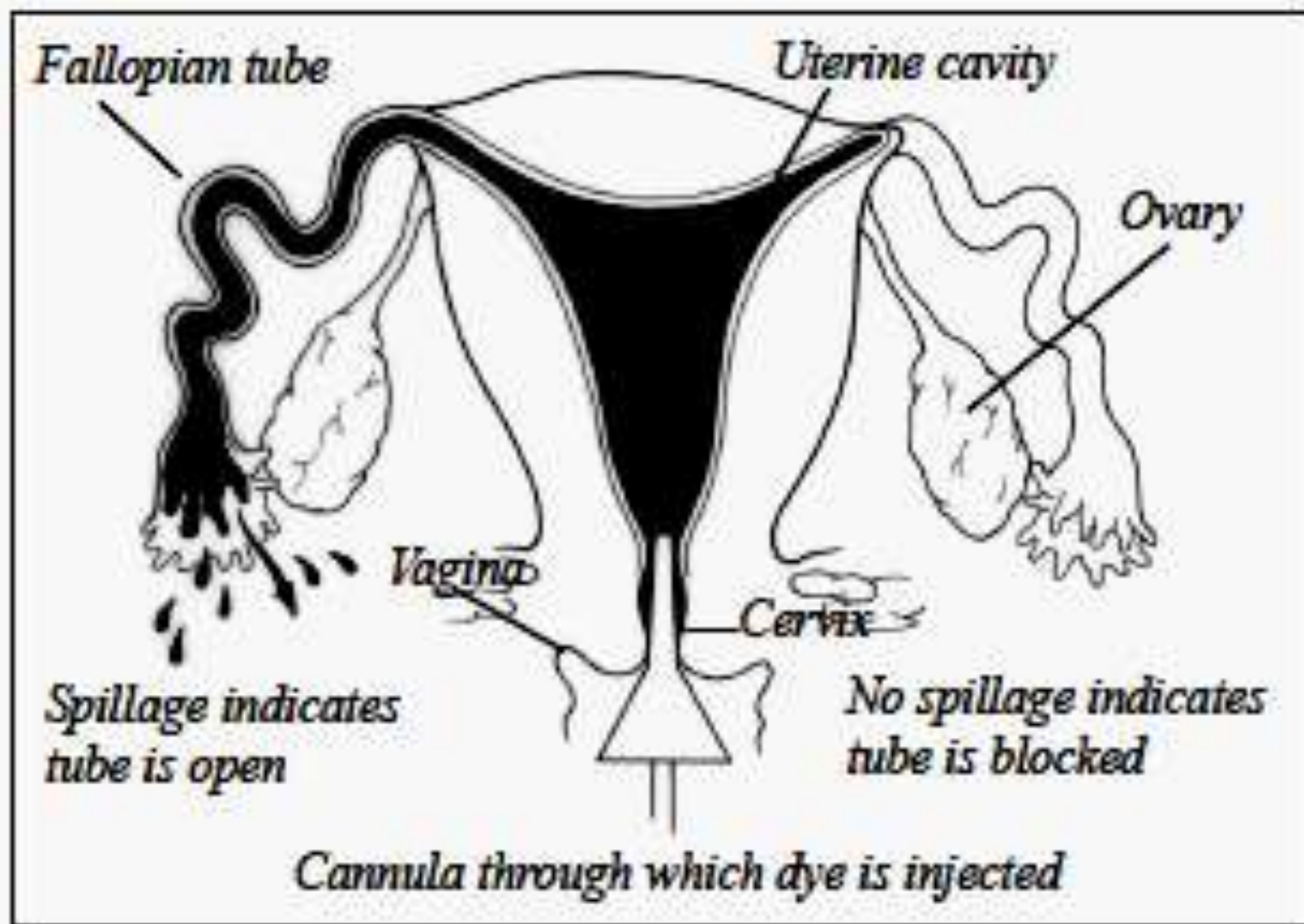




Figure 1

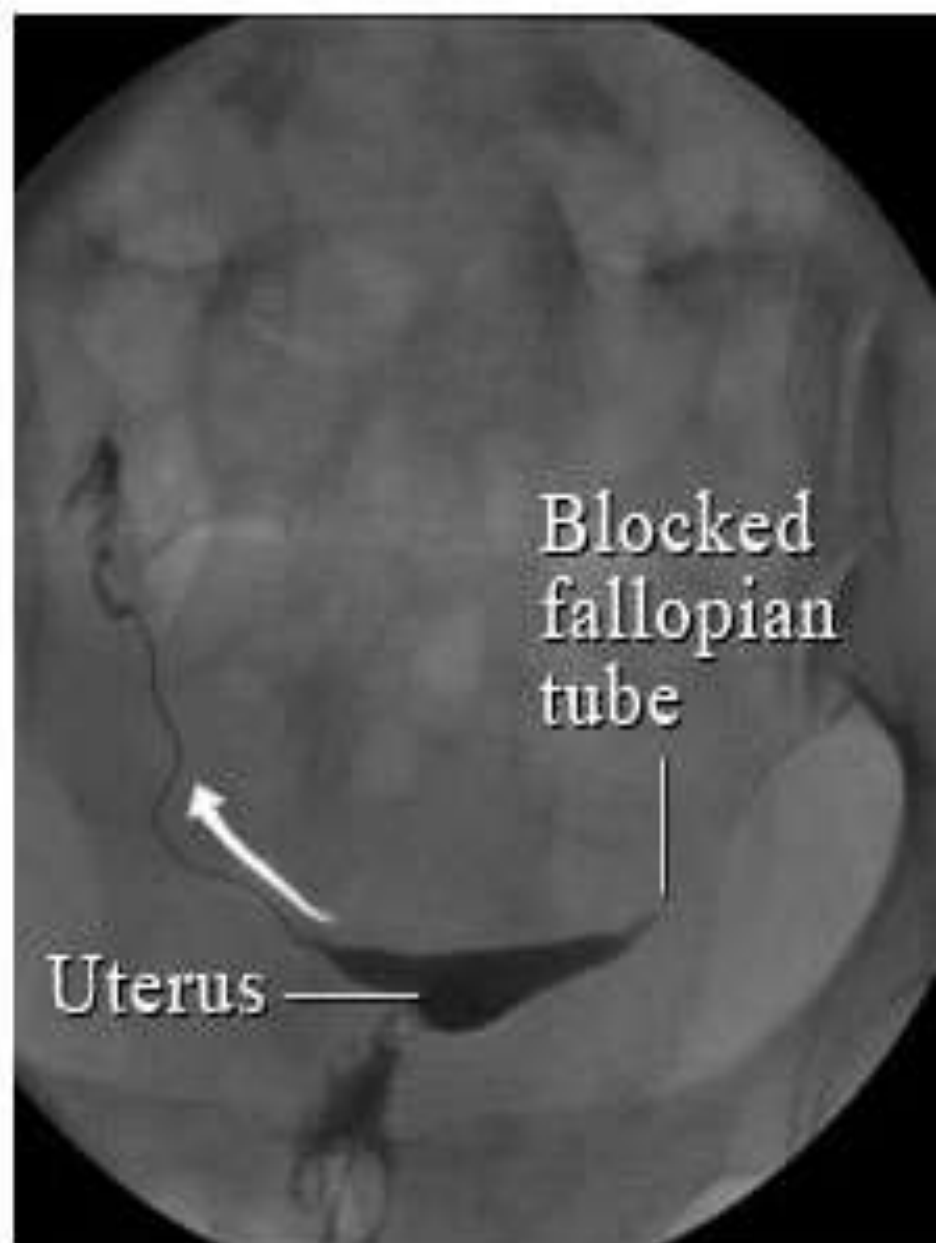


Figure 2

External Adhesions

- **occur secondary to :** (*similar to the causes of tubal occlusion*).
 - previous inflammation or
 - surgery,

Peritubal adhesions → prevent contrast material from flowing freely around the bowel loops “*as seen in normal cases*”,

- **Most commonly manifest as :**
 - loculation of the contrast material around the ampullary portion of the tube.



CASES & Quiz



Double uterine
contour
← Improper
imaging time

**“Secretory
Phase”**



NORMAL HSG

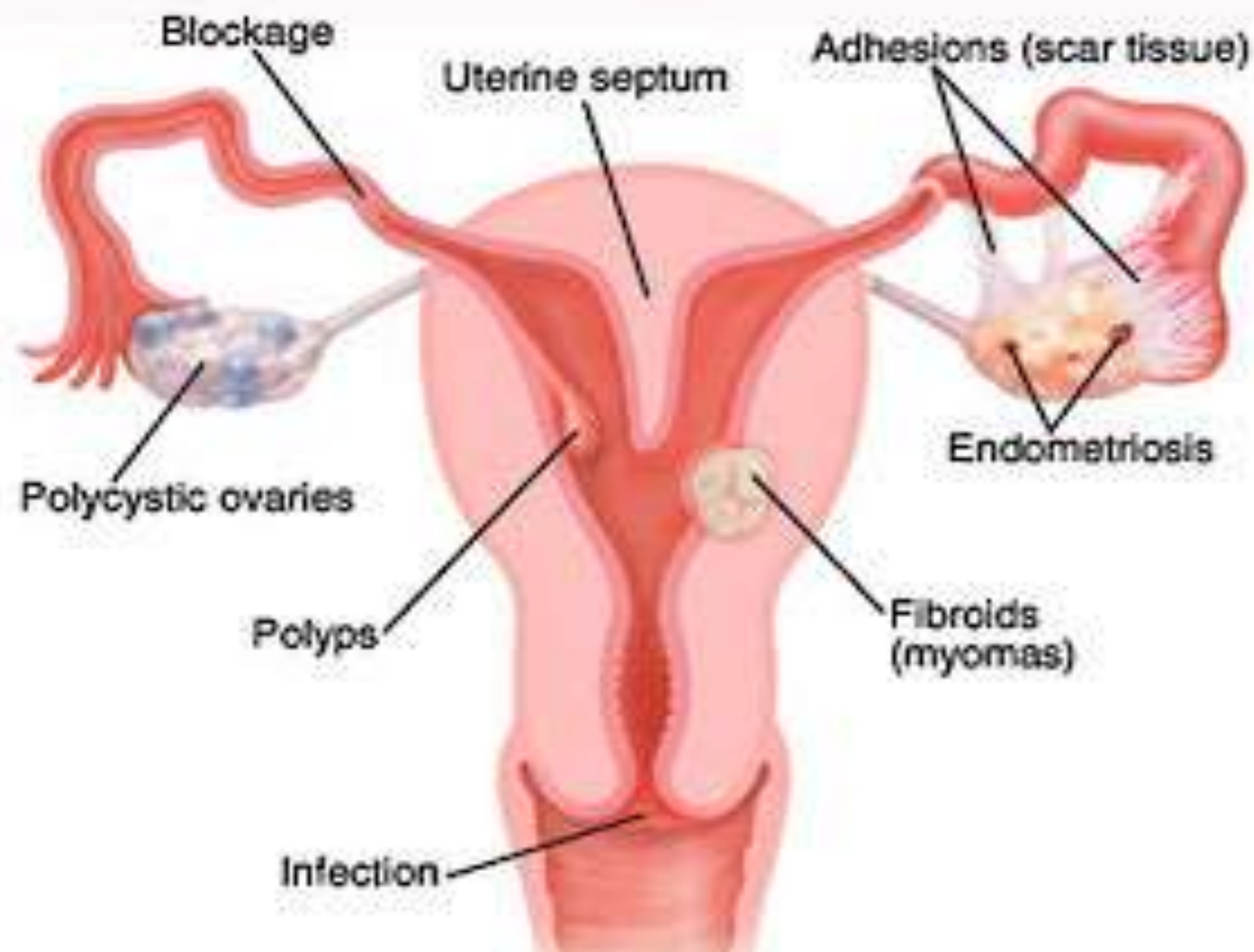
Injected air bubbles



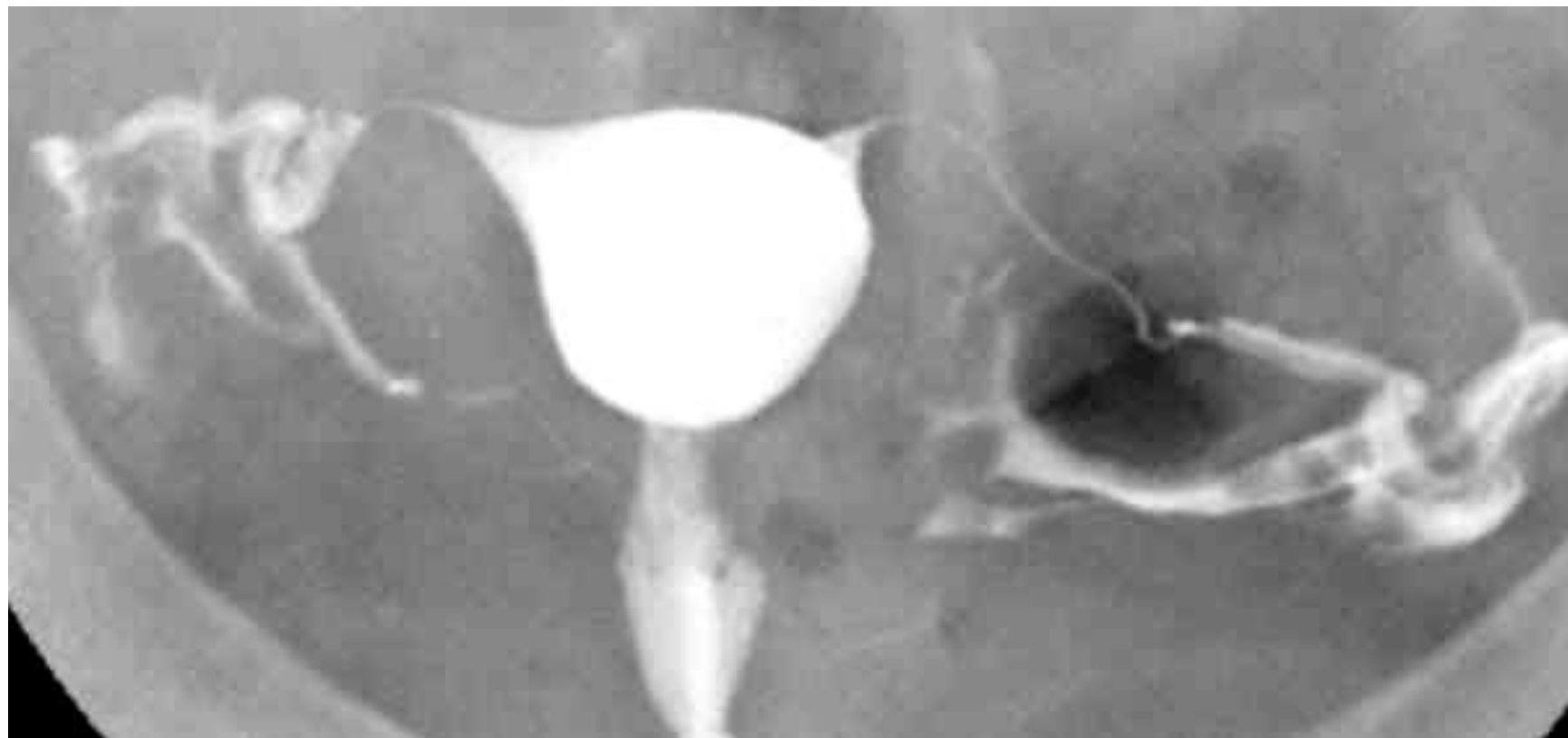
IMPROPER IMAGING

Inadequate cervical pulling
Uterus is markedly anti - flexed









CHOCOMA PORTSMOUTH DEPT DIGITAL IMAGE

5m 00m
5m 00m
5m



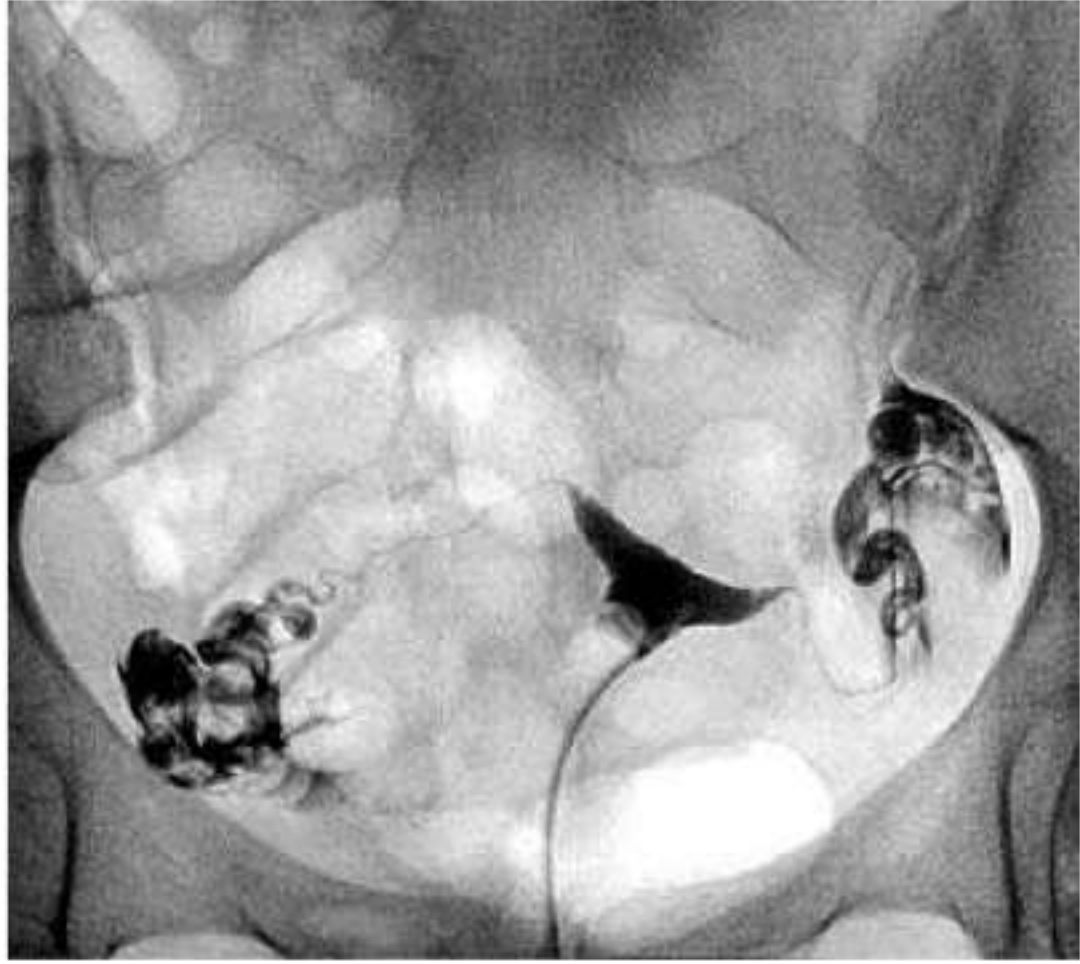
48 00M 7 124 00M / 48 10
48 200 1 1 1 1





R





Normal Hysterosalpingogram

Open Fallopian Tubes

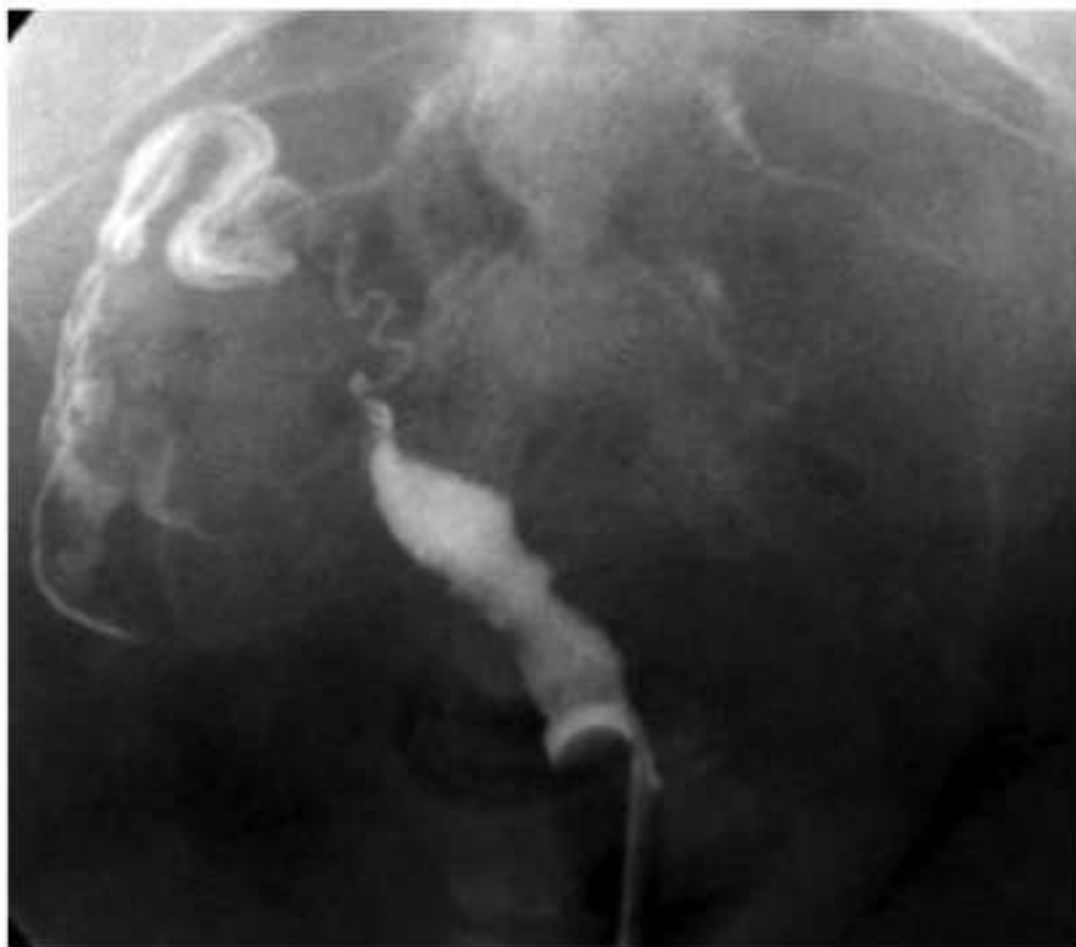
Normal Uterus













Conclusion

- HSG remains the ***front-line imaging*** modality in the investigation of infertility.
- It is an ***accurate*** means of accessing the **uterine cavity** and **tubal patency**.
- but it has a low sensitivity for the diagnosis of pelvic adhesions, ← it cannot replace laparoscopy.
- It requires *knowledge of the female anatomy* as well as *skillful technique* in order to avoid pitfalls and misinterpretations.

Link of Video Lecture

- <https://www.youtube.com/watch?v=O1eCAy34e3M>

References:

- Hysterosalpingography: Technique and Applications ., Athanasios Chalazonitis, MD., et al , Curr Probl Diagn Radiol, September/October 2009.
- The WHO manual of diagnostic imaging, Radiographic Technique and Projections. Editors Harald Ostensen M.D.
- HSG film reading_Dr Rasha Kamal

THANK YOU

Ahmad Mokhtar Abodahab - MD

May 2022